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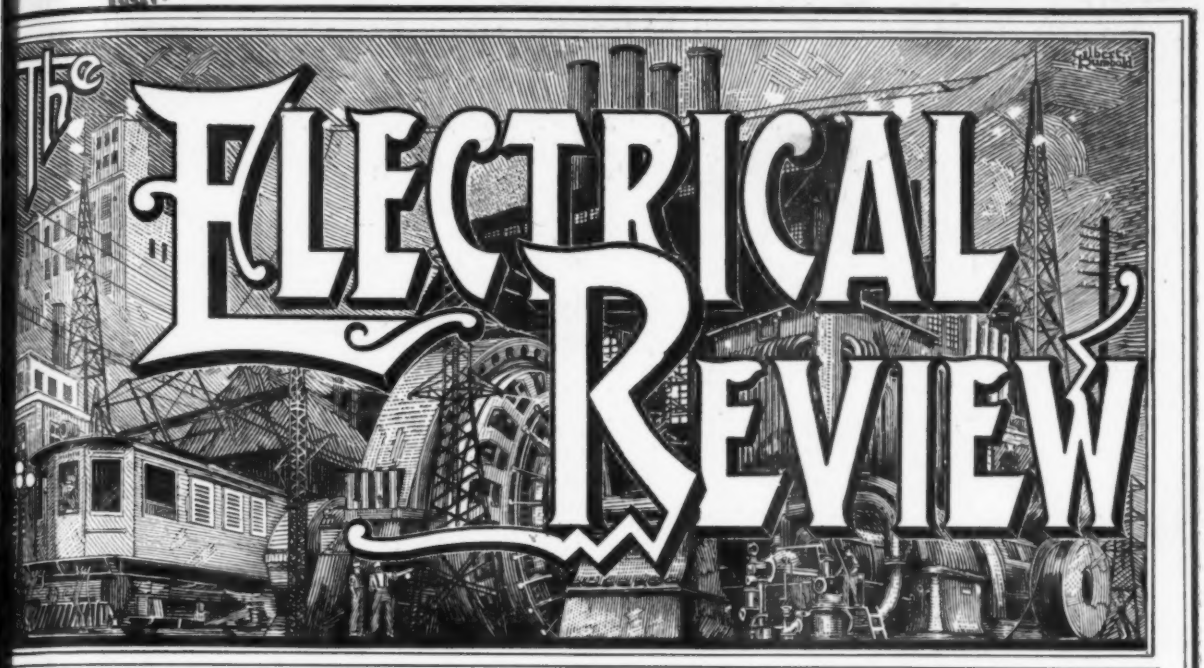

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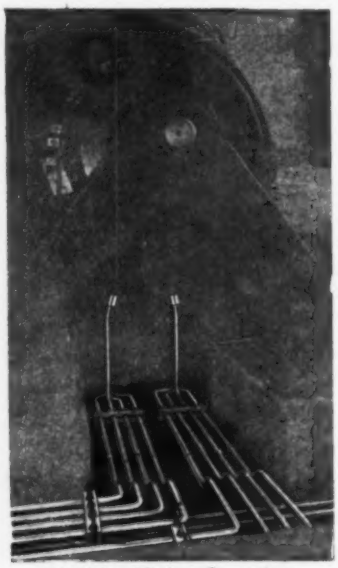

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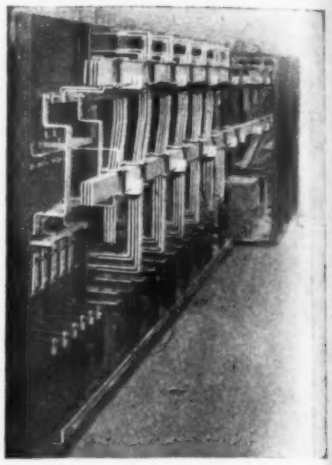

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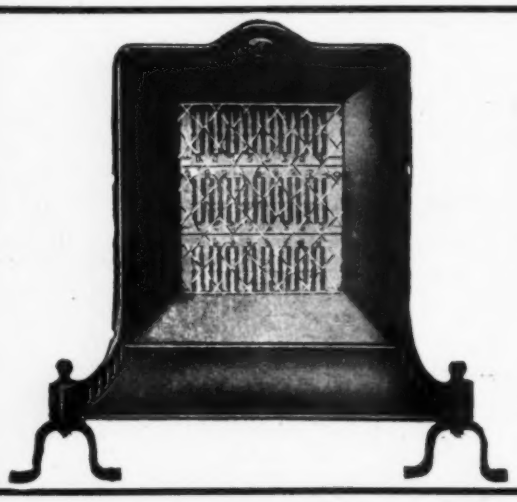

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ELECTRICAL REVIEW.

VOL. XCIII. NOVEMBER 2, 1923. No. 2,397.

ELECTRICAL REVIEW.

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THE FULHAM STRIKE.

THE dispute at Fulham, London, which originated in the cleansing department of the Borough Council and eventually resulted in the cessation of electricity supply for nine hours on Thursday last week, calls for critical examination not on account of its peculiar importance, but with regard to its influence in point of principle and precedent. First let us state the facts as we know them: the Borough Council, having withdrawn from the London District Joint Council for Local Authorities' (non-trading services) Manual Workers, which deals with the wages and working conditions of scavengers, roadmen and others, proposed to change the method and rates of payment of the dustmen, departing from the scale and system approved by the Whitley Council. Other Trade Unions having members in the Borough Council's employ (including the Electrical Power Engineers' Association, the Electrical Trades Union, and others concerned in electricity supply), some 10 in all, represented by the recently formed Municipal Employés' Defence Committee, protested against this proposal on the ground that this was a first step towards throwing over the Whitley system in all of the undertakings of the Corporation, and as the latter took no heed of the protest, the electrical Unions gave a week's notice of their intention to cease work at the Fulham generating station unless a settlement were achieved. At the same time, the members of the Electrical Power Engineers' Association employed by the Corporation intimated that in the event of such action being taken they would not undertake to instruct or supervise "blackleg" labour in order to keep the plant running, nor would they undertake other than their normal duties; thus, whilst not giving notice to terminate their engagements, in effect they acquiesced in the cutting-off of the public supply of electricity. The strike rapidly extended, and efforts were made to arrive at an agreement settling the dispute, but the Corporation was obdurate up to within an hour of the time appointed for the shut-down of the power station; a truce was then called on terms accepted by the men's representatives, but it was too late to reverse the decision, and when the supply was cut off the employés concerned refused to return to work until a definite settlement was recorded. Supply was resumed at 9 p.m., after the inhabitants of the borough had suffered grave inconvenience, and some 15,000 or 20,000 workpeople had lost half a day's work.

Brushing aside all minor matters, the chief point at issue was the maintenance of the Whitley system; the original strike of the dustmen was based upon this question, and all subsequent negotiations equally rested upon it. We have so long and so earnestly pleaded for adherence to this principle, the observance of which would go far to put an end to strikes by substituting reason for force, that we must unhesitatingly support the contention of the Trade Unions—that wages and working conditions should be settled by the Whitley Councils and not by individual negotiation. For the same reason we hold the Fulham Borough Council responsible for the trouble which it brought upon itself by its secession from a Whitley Council. But whilst in this respect our sympathies are with the employés, we cannot approve of the method which they adopted to impose their views upon the employers. We have always deprecated the use of a great and essential public service such as that of electricity supply as a weapon with which to enforce decisions in questions extraneous

to that service. In this instance, whilst the electrical workers might be apprehensive lest the next step would be to jettison the Whitley system in the electricity supply industry, the fact was that that question had not arisen. The dispute was wholly alien to their industry, and in our opinion their altruism was misplaced. They are amply strong enough to protect themselves, and it is not their function to take up arms on behalf of other industries—if it were, the future of electricity supply would indeed be jeopardised. We hope, therefore, that the electrical unions will in future refrain from entering into any alliance or engagement which may result in action such as that which was taken at Fulham. The Whitley system is a bulwark against breach of continuity of supply; to interrupt the supply in order to uphold Whitleyism is a Gilbertian procedure.

A Pillar of the Industry.

The members of the National Industrial Council for Electricity Supply gave a dinner on Thursday, October 18th, in honour of their chairman, Mr. Alderman Walker, of Manchester, who has been chairman of the National Council since its inception in 1919 and of the National Joint Board from its beginning. We do not know the record of his attendances in presiding over the meetings, but we understand it approximates to 100 per cent. We do not know his presidential efficiency, but we should imagine it might be taken at the same figure. Certainly if the success of the Whitley system in the electricity supply industry is to be attributed to the unselfish devotion of a certain small group, Alderman Walker is admittedly the outstanding figure. We use the words "unselfish devotion" deliberately, since none of the members of the National Council "get anything out of it." It is a case of "all kicks and no ha'pence." Yet the service rendered to the industry by the National Council, and by Alderman Walker, with whom lies the major credit of keeping the whole thing going, is immense. But it is doubtful whether the industry realises its indebtedness.

The general atmosphere has been one of mute discouragement, criticism when things have gone wrong, unappreciative acceptance when things have gone well. It speaks well for the sterling qualities of the chairman that he has carried on with unswerving loyalty to his task in the face of such general indifference.

It must, therefore, be all the more gratifying to the chairman to feel how warmly his work is appreciated by his colleagues, the members of the National Council.

Doorway to Russia: Esthonia's Progress.

There is much in the report of the Department of Overseas Trade on Esthonia that agrees with the hopeful view taken by the British members of Parliament who recently made a tour of the Baltic States. These gentlemen perceived great possibilities of trade there, especially as Germany, which formerly dominated the market, is at present unable to quote competitive prices. If British firms succeed in obtaining a good footing now, they will be in a splendid position to benefit by the business with Russia which is bound to develop before long, and will be largely conducted through these new States.

With regard to Esthonia in particular, H.M. consular officers at Reval speak very appreciatively of the general stability of the country and the avoidance of currency inflation. While the low rate of exchange of the Esthonian mark is, they say, admittedly disadvantageous to foreign trade, the absence of violent fluctuations has increased the confidence of business men in their dealings with the country. While prudence must still be exercised, it would be a mistake, it is added, to resign, out of an undue sense of caution, relatively valuable openings to foreign competitors.

For instance, in connection with the erection of machinery or plant, and generally with those matters where the risk is only coterminous with the interval between the delivery or erection and payment, the possibilities of the Esthonian market are stated to be worthy of more attention on the part of British traders and manufacturers. On grounds of sentiment and on account of an appreciation of their high quality, there is in Esthonia a real interest in British products.

Electrical goods, lamps, fittings, &c., are reported to be in demand in the towns. If the schemes proposed for the utilisation of the falls of the Narova for the production of electric power are realised, this opening will become of increasing interest to foreign manufacturers for export. It may here be mentioned that the recent report of the "Eesti Pank" stated that the Northern Paper and Pulp Works, Ltd., would, in the course of the year, complete a scheme at Jägala which would supply 1,500 h.p., and that in the near future it was intended to utilise the water power of the River Pernau near Tori (2,500 h.p.). A consular report refers to the project for using peat as fuel for electric power stations. It is planned to supply the town of Reval from a distance of about 60 km. It is proposed this year to provide a service of electric trains between Reval and Nömme (8 km.) and Dorpa and Elva (26 km.).

Electrical Legislation in Norway.

An addition is now proposed to be made to the various existing laws in relation to the production and distribution of electrical energy in Norway. When the first concession law made its appearance quite a number of years ago, its promoters stated that the object was to preserve the natural resources—the waterfalls—for the benefit of the country, this being directed apparently against foreign enterprise in Norway, and to prevent any individual company from obtaining a monopoly. Since then the concession laws have been gradually made stricter, and have become less in agreement with the original intentions. Native companies have not enjoyed any advantage over foreign enterprise or, put in other words, the disinclination to grant concessions to foreign companies has been extended to native companies, and the new Bill now under consideration is held to be a further step in the direction of the elimination of private initiative in electricity supply. At least this is the opinion expressed by the Norwegian Private Power Works Association in a petition presented to the general directors of the State Watercourse and Electricity Administration.

From an economic point of view, the experience of the Norwegian State in the matter of the ownership of certain hydro-electric works has not been very fortunate, nor has that of a number of communes which, as was recently mentioned in this journal, have applied for Government financial assistance owing to the inability to meet all the charges on their electricity supply works. But while a deficit on State working of undertakings can be borne by the nation, the question in regard to some of the communes has proceeded so far as to have raised a discussion and inquiry as to whether the communes can become bankrupt! Under these circumstances the Association suggests for the consideration of the Government that (1) the State should only act as an authority for the grant and control of concessions, and that (2) the communes and private enterprise should be equally welcome contributors towards the electrification of the country.

In furtherance of the first proposal, the Association suggests that the Bill should be amended so that the State would abstain from competing for the establishment of electricity works, and that no fresh concession should be required for the modernisation of existing works. A concession duration of 50 years is regarded as being too short a period, and a term of a minimum of 75 years is recommended. The taxes and imposts placed upon holders of concessions are declared to hamper development, and it is urged that they should be abolished. Not only so, but it is held to be an unfortunate practice for the taxes and imposts to be imposed only on private enterprise, while the interested local authorities and communes have remained exempt from these burdens.

The Powers of the P.M.G.

Elsewhere in this issue Mr. S. C. Bartholomew again takes up the cudgels and discusses in detail the minutiæ of Mr. Stoker's articles and our comments. Whilst the time available between receiving his article from the printer and going to press does not permit us to deal with it at length, the general impression which it leaves on our mind is that the discussion is degenerating into a battle of words, and that we are not making much progress either way. For instance, Mr. Bartholomew is at some pains to show that Sir Philip Dawson's book was published not in 1905 but in 1909, and that in 1911 he corrected the statement that a 20-volt limit had been fixed for a.c. railway traction. The dates are not material, and the fact that it was not thought necessary to impose a limit on the drop in the rails, supports our contention that the use of the earth as a return is not unreasonable. The reference to Mr. Cooper's dictum leaves us cold, for no one proposes, or would think of proposing, to use a high pressure in the return circuit; under practical conditions it is correct to say that corrosion effects due to an a.c. earth return are negligible. Again, what Dr. Ferranti said after dinner about his experiences on the Deptford system in the 'eighties of last century was amusing, as he meant it to be, but to quote it as relevant to the question at issue is but trifling with the matter.

We have already pointed out that the working conditions on electric railways, d.c. or a.c., are far more strenuous than on an ordinary supply network; whilst we admit, of course, that difficulties have been met with in the vicinity of such a.c. railways, the fact that thousands of miles are in operation is proof that the difficulties can be overcome, and by the use of a current wave without harmonics those difficulties would be minimised. With regard to the general question of the relations of the Post Office and electricity undertakings, we may refer the reader to our "Correspondence" columns to-day; Mr. Fennell's statements are borne out by those of other correspondents which are not intended for publication. Whereas the Postmaster-General, through his staff, has hitherto acted as though he held the right of veto, we maintain that he has no such right. According to the Acts of Parliament he must be "reasonable," and the onus of proof rests on his shoulders, to show cause why certain things should or should not be done. Arbitrariness is a well-known characteristic of bureaucracy; but, left to themselves, engineers are by training and experience open-minded and reasonable men, and we feel sure that if the Post Office engineers and those of the supply undertakings were to discuss these questions in a friendly spirit, under the benevolent patronage of the Electricity Commissioners, they would be able to arrive at a solution which would do them credit and would benefit the public.

Staff Efficiency.

Do those responsible for the management of electricity supply undertakings realise how much the success of their undertaking depends on the efficiency of their staff? Have they seriously considered whether their executive and superintending staff are working at one hundred per cent. efficiency? Electricity supply is, in the first place, a public service; in the second place, a commercial business. But whether we look at it from the point of view of performing a duty to the community or of making profits, in each case the degree of success obtained depends on every responsible officer doing his best to the utmost. Two men of equal nature and ability will vary widely in respect of the service they render to their undertaking. One man will give a minimum and the other a maximum of service. One man will "carry out his duties"; the other will give every ounce that is in him of initiative, energy, and thought. The difference which these two alternatives make to the progress of the undertaking is obvious. The question is how to transform the one attitude of mind into the other. The answer is: make it worth the man's while in some way or other. The exact method is a matter for consideration; but the way *not* to do it is to treat the staff as automatons, and look only at the salary list and not at what work is being obtained. The desideratum is that every man in a responsible position should act as though the undertaking were his own private business, and energise accordingly. But this cannot be expected to happen without proper incentive. The tendency to treat the staff as automatons is perhaps more marked in the case of local authorities than of companies. This attitude of mind is evinced, for instance, in the bald resolution recently passed by the Warrington Council that the salaries of the technical staff under the existing schedule are "excessive," and that the usual representations be made to the National and District Boards. This resolution has since been adopted by a certain number of other local authorities. We are not at the moment concerned with the merits of this particular case. We merely take this as a topical illustration of the tendency to concentrate attention on how much is being paid instead of on how much is being got for the money. The real question for those in charge of an undertaking is to produce cheap units. But do cheap men produce cheap units? This brings us back to our theme, that ultimately the absolute value of the salary is not the real consideration. What does matter is the efficiency of the staff.

Pre-war Prices.

The inhabitants of Luton are to be congratulated. The borough electrical engineer, Mr. W. H. Cooke, informs us that the Corporation has reduced the price of electrical energy to the pre-war level—and once more the "Point Five" tariff for heating and cooking is in operation! We give particulars of the scale of charges in our "Lighting and Power Notes," from which it will be seen that electricity for other purposes is to be had at remarkably low rates—any consumer whose load factor is 50 per cent. or more is charged at less than 0.5d. per kWh, and even the flat rate for lighting is only 3½d. We do not suggest that in all respects the Luton tariff is the lowest extant—but it must be remembered that this is a small undertaking, with a maximum demand of 6,300 kW. Last year, with an average price of 1.51d. per kWh sold, it made a net profit of £11,215, the total costs including capital charges being 1.291d. per kWh sold. There are many undertakings ten times the size that cannot make such a good showing. And where else is the "Point Five" tariff in force? Evidently mere magnitude of station or system is not the only factor in economical production, and due credit must be given to Mr. Cooke for the efficiency of his management.

Inquiry as to the secret of his success elicits the statement that the undertaking, of which he has been in charge for over 20 years, has always aimed to supply electricity at the lowest possible price, to keep down capital charges, and to apply all the profits for the benefit of the undertaking. "Cheap current," he says, "is the best method of advertising the value of electricity." The high cost of coal after the war compelled attention to the improvement of thermal efficiency, and his fuel costs are now much below pre-war costs, though the price of coal is 80 per cent. above that prevailing before the war.

Orders Going Abegging.

On more than one occasion recently we have received complaints to the effect that, despite the need for business in order to remedy the unemployment under which the country suffers, British manufacturers look askance at propositions that are laid before them and refrain even from quoting prices for manufacturing articles to order. A case in point will be found in our "Correspondence" columns to-day, where British firms were asked to undertake the manufacture of a line of small motors, d.c. and a.c., in accordance with a specification which appears to present no insuperable difficulties—indeed, we understand that the machines referred to have hitherto been made abroad, and if others can make them, we can. It would be interesting to learn why no British maker has thought it worth while to accept the order.

D

OVERLOADS AND SHORT-TIME RATINGS.

By REGINALD O. KAPP, B.Sc., A.M.I.E.E.

A problem that arises frequently in connection with electrical plant is, for what period of time under given conditions such plant will safely stand a given overload. If sufficient design data of the plant are known, the problem is a determinate one, and a result can be arrived at by calculation, but the calculation involves somewhat transcendental mathematics, and is generally too complicated to be found worth while. This is, therefore, a case where a simple graphical solution is a help. In the following, such a solution is given that is applicable to transformers or cables. The case of generators and motors is a more complicated one, depending on too many variables to make any solution a simple one.

If a steady load is supplied continuously, the ultimate temperature rise is proportional to the losses. The losses are some function of the load. In many cases, such as cables, starters, busbars, or switches, the losses are proportional to the square of the load. In transformers, one part, called copper loss, is proportional to the square of the load; the other, termed iron losses, is independent of the load. In other cases, such as running machinery, there are losses, such as brush losses, which are some other function of the load, and in cases where machinery is worked at varying speeds or varying voltage, the relationship of losses to load becomes very complicated. Moreover, the independent parts of such machinery can stand different limiting temperatures, and each follows its own law of heating. In consequence, no simple relation between the rated load and a short-time overload can be established.

We will, therefore, confine our investigation to the conditions in a transformer, and simpler apparatus, such as cables, resistances, &c., may be treated as a special case of this.

Let the losses independent of the load $= a$.

Let the losses proportional to the square of the load $= b$ at the continuous rating.

Let the load at continuous rating $= \text{L}$.

The load at short-time rating $= \text{L}+l$

Let the ultimate temperature rise at continuous rating $= \text{T}_o$,

Let the ultimate temperature rise due to $\text{L}+l = \text{T}$ if applied continuously.

$\text{T}_o = c\,[a+b]$.

$\text{T} = c\,[a + b\,(\text{L}+l)^2/\text{L}^2]$.

$\text{T}_o/\text{T} = (a+b)/[a + b\,(\text{L}+l)^2/\text{L}^2]$.

Let $a/b = \alpha$; $(\text{L}+l)/\text{L} = \beta$.

Then $\text{T}_o/\text{T} = (\alpha+1)/(\alpha+\beta^2)$.

It is found that for practical work it is sufficiently accurate to assume that the radiation is proportional to the temperature above the surrounding atmosphere, and on this assumption the well-known heating law is based:—

$$y/\text{T} = 1 - e^{-x/c}$$

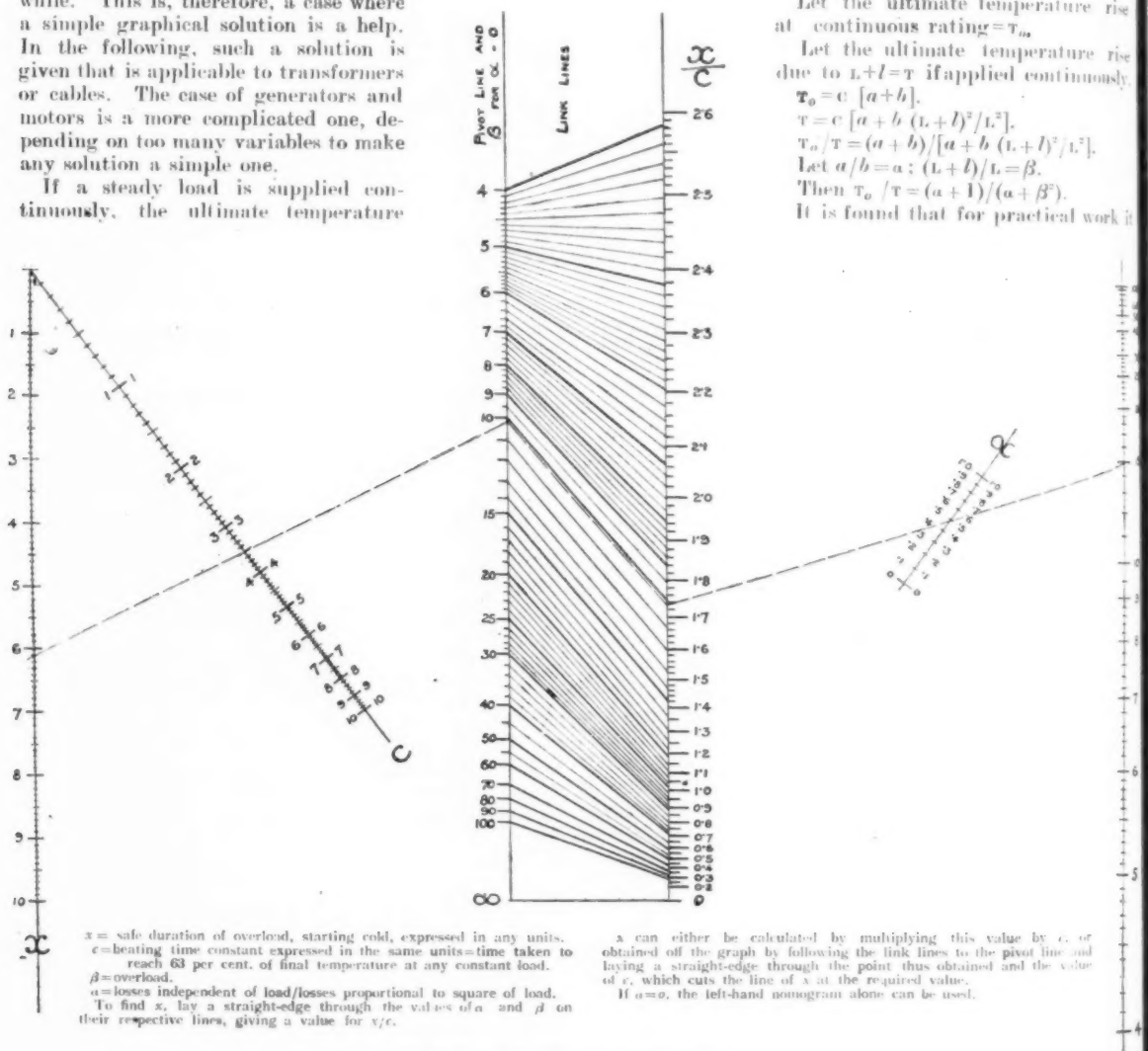
where y is the temperature reached after a period of time x, T being the temperature which would be reached after an infinite time, and c being a constant depending on the capacity of the plant for storing and dissipating heat; c is called the time constant, and is the time taken to reach 63 per cent. of the final temperature.

If y is the safe limit of temperature rise, it becomes equal to T_o and we get

$$(\alpha+1)/(\alpha+\beta^2) = 1 - e^{-x/c}$$

which can more conveniently be written

$$e^{x/c} = 1 + (\alpha+1)/(\beta^2-1).$$



x = safe duration of overload, starting cold, expressed in any units.
c = heating time constant expressed in the same units = time taken to reach 63 per cent. of final temperature at any constant load.
β = overload.
α = losses independent of load/losses proportional to square of load.
To find x, lay a straight-edge through the values of α and β on their respective lines, giving a value for x/c.

x can either be calculated by multiplying this value by c, or obtained off the graph by following the link lines to the pivot line and laying a straight-edge through the point thus obtained and the value of c, which cuts the line of x at the required value.
If $\alpha = o$, the left-hand nomogram alone can be used.

Fig. 1.—Nomogram of Overloads.

From these equations, values for the variables could be obtained from families of heating curves or by direct calculation with the help of logarithmic tables. Both methods would be much too complicated for practical use if rapid work is required or a number of alternatives have to be considered. Fig. 1 gives a solution to this equation for any value of x and c and for all values of α and β likely to arise in practical work. This figure is a nomogram, though it is represented in somewhat unusual form. As the formula does not lend itself to orthodox methods of nomographic representation, it is really a combination of two independent nomograms, the right-hand side solving the equation—

$$e^{x/c} = 1 + (\alpha + 1)\ (\beta^2 - 1)$$

treating x/c, α and β as independent variables. This gives the familiar z type of graph, the line of α joining points on the parallel lines for which $e^{x/c} = 1$ and $\beta^2 = 1$ respectively.

The left-hand side solves the expression—

$$x/c = \log\ [1 + (\alpha + 1)/(\beta^2 - 1)],$$

treating x, c, and $[1 + (\alpha + 1)/(\beta^2 - 1)]$ as independent variables. This is also a z type of graph, the line of c joining points where $x = 0$ and $\log_e [1 + (\alpha + 1)/(\beta^2 - 1)] = 0$. The link lines, therefore, join corresponding values of $\log_e [1 + (\alpha + 1)/(\beta^2 - 1)]$ on the left-hand side, and $[1 + (\alpha + 1)/(\beta^2 - 1)]$ on the right-hand side.

The diagram can be used without any scale divisions being marked on the central lines, but for practical purposes it is convenient to be able to use only the right or left-hand side of the diagram. The right-hand side gives values for x/c, from which x is readily

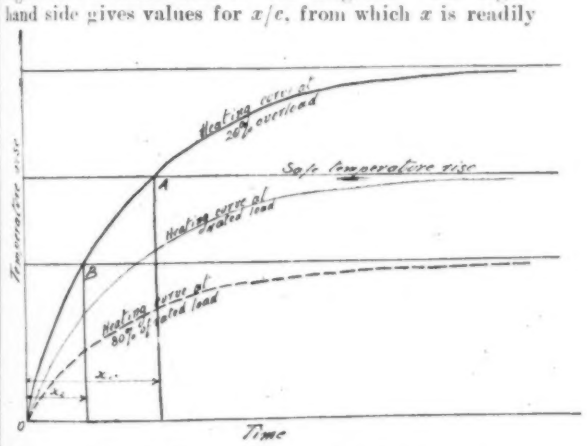


Fig. 2.—Heating Curves of a Cable.

obtained with the help of a slide rule. The left-hand side can be used alone for the large number of cases where $\alpha = 0$.

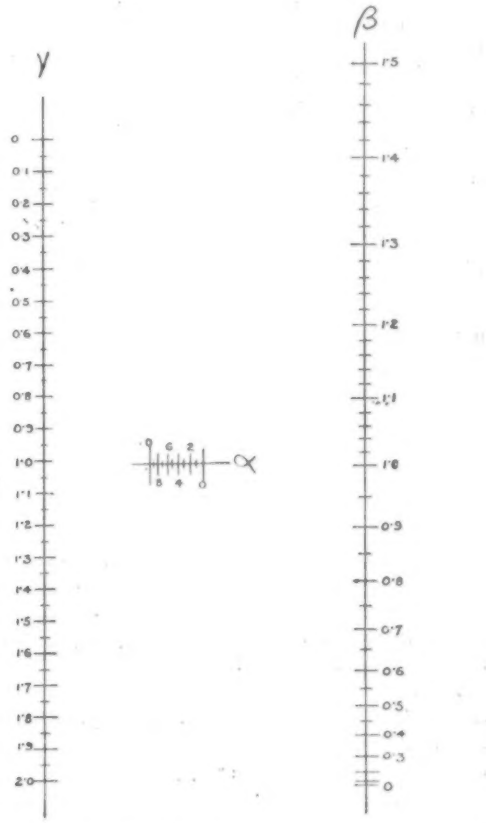
In the case of a transformer, the same applies as was said with reference to a motor above, that the heating law of individual parts is different, or, in other words, the winding, core, oil, &c., each have their own heating time constant, whereas the nomogram treats the transformer as a whole. It does not take account of the possibility of hot spots, but assumes that any temperature rise due to load instantaneously occurs throughout the whole transformer. This assumption is obviously incorrect, but for small overloads lasting a long while it is not very wide of the mark. The nomogram should, however, be used with great care for heavy overloads of short duration where the limiting feature is the development of hot spots.

It will be seen that the nomogram can be used for cables, starters, or any apparatus in which temperature rise is proportional to the square of the current only, provided the heating curve is near enough to a logarithmic curve for practical purposes.

The diagram could also be used to solve certain other problems: for instance, for a rough calibration of fuse wires with the help of two tests. In the first test a current should be applied and gradually raised to fusing point and the fusing value of the current noted. We can treat this current as if it were a full load on the fuse wire for the purposes of the investigation. In a second test any convenient measured current greater than the fusing current should be applied and the time for fusing measured. The ratio of the current in the second test to the current in the first test may be called β, and the time for fusing in the second test x. A straight-edge through the corresponding values of β and x on the left-hand side of the diagram will cut the slanting line at a point c, which will give the time constant in the units of time in which x has been measured. Once the time constant has been established by these tests for the given fuse wire, the diagram will give any relations required between β and x, and thus enable a calibration curve of the fuse wire to be drawn.

The service condition for overload on a cable or transformer is not necessarily one under which the overload is put on when the plant is cold. It is possible, however, with the use of the nomogram, fig. 1, to obtain the period of safe overload starting from any known service condition. Two cases may arise:—

1. Full load is defined as the load giving the maximum safe temperature if applied continuously; the



Formula: $\beta^2 - 1 = (\gamma - 1)(\alpha + 1)$.

γ = Permissible temperature rise/rated temperature rise.

β = Permissible load/rated load.

α = Losses independent of load/losses proportional to square of load.

Fig. 3.—Nomogram of Relative Outputs for Various Service Conditions.

plant has been working continuously at some lesser load, and it is desired to find for how long a stated overload may be applied.

2. The stated full load of the plant is less than that applied continuously to give a maximum safe temperature, and an overload of 25 per cent. may be applied safely for a stated time after continuous working at full load.

After working continuously at any other load than full load, we wish to apply a stated overload and to find out for how long it can be safely applied.

Case 1 is the simpler. As a typical case we will con-

sider a cable for which full load is always defined as the safe maximum continuous load.

Consider fig. 2, in which it is assumed, for example, that the cable has been working at 80 per cent. of full load continuously. We wish to find for how long 20 per cent. overload may be applied safely. The 20 per cent. overload curve is shown on the drawing with a full line. It is clear that this load may be applied until temperature A is reached, and that when we start to apply the load temperature B had been reached. The safe time is, therefore, $x_1 - x_2$.

x_1 is the safe time for applying 20 per cent. overload starting cold. Suppose the cable has a time constant of two hours, we then find from the diagram, fig. 1, by laying a straight-edge through 20 on the line of β and 2 on the line of c

$$x_1 = 2.4 \text{ hours.}$$

To find x_2 we must treat B as if it was full load; the heating curve then becomes one corresponding to $1.2/0.8 = 1.5$ or 50 per cent. above the previous load, and x_2 is the intersection on the line of x of a straight-edge through 50 on the line of β and 2 on the line of c, giving 1.2 hours. From these two readings we find:

$$x_1 - x_2 = 1.2 \text{ hours.}$$

As an example of case 2 above, we will consider a transformer. Suppose it is designed to give an overload of 25 per cent. for two hours after continuous work at the rated load. We must first find the safe continuous maximum load it could give.

If fig. 2 be drawn so that line B corresponds to the rated load and line A to that load which applied continuously would give the maximum permissible temperature rise, we can say that

$$x_1 - x_2 = 2 \text{ hours,}$$

when x_2 corresponds to 25 per cent. overload.

From these figures x_2 can be found. For instance, if the transformer has a ratio of iron to copper losses of 0.6 and a time constant of 4 hours, x_2 for a 25 per cent. overload is obtained from the diagram, and is equal to 5.4 hours; x_1 is, therefore, 7.4 hours. We have incidentally found that the transformer could stand a 25 per cent. overload starting cold for 7.4 hours. We must now find what ratio this 25 per cent. overload bears to the safe continuous maximum load. We know it is a load which can be applied safely for 7.4 hours. The diagram shows us that this corresponds to a value of β of about 17 per cent. The safe continuous overload is, therefore, 17 per cent. above the rated load, and with this we can proceed as previously for case 1. The method may appear more complicated in its description than it is in actual application.

Another set of calculations is sometimes necessary in the case of electrical plant where the service conditions vary. The plant can stand a certain final temperature, and it is rated on the assumption that the ambient air temperature has a given value. If it is installed under abnormal conditions in a hot engine room, for instance, or in a tropical climate, the rating must be correspondingly altered. In a case where the losses are merely proportional to the square of the load, the calculation for the revised rating is simple. In the case of a transformer it is not so simple. It can be shown that

$$\gamma = (\alpha + \beta^2)/(\alpha + 1),$$

and this formula can also be presented in the form given on the nomogram, fig. 3. With the help of this diagram we can now find out what proportion of the ultimate temperature rise the transformer treated in the above example would have when working continuously at the rated load. We found that the maximum safe temperature rise would be reached with 17 per cent. overload, or, in other words, the rated load is $100/117 = 85.5$ per cent. of the safe continuous load. A straight-edge on fig. 3 through 0.855 on the line of β and 0.6 on the line of α cuts the line of γ at 0.83. So the transformer at its rated load works at 83 per cent. of the permissible temperature rise.

THE ROMANCE OF CANVASSING.

By E. M. B.

According to rumour, or some other poet, life is but a little game, and another authority has it that tragedy and humour are but a step apart. These statements can be vouched for as true to life by any one who has canvassed for consumers.

The trouble generally originates with the man in the street who runs the fish and chip shop. Shakespeare tells us that the ages of man are seven, but the average fish and chip merchant can generally manage with three.

First, on opening out, practical poverty; then, and after a short reign, electrical equipment; and lastly, an El Dorado, which, being interpreted, is a non-subsidised house on the outskirts of the town. But this by the way.

This gentleman is one of a race who always live at least one hundred yards from a main. He comes into the mains office and requests a supply which necessitates a canvass for consumers between him and the main.

Nowadays only owner-tenants become consumers, and it is a stock question to ask an inquirer if he knows of any owner-tenant *en route*. Even a hardened mains man is often amazed at the knowledge that some people possess of their neighbours' doings.

The canvasser arrives in the street, and commences calling from door to door, and the following lines illustrate the pilgrim's progress.

As the writer proposes to open a school, by correspondence, for the acquisition of the art of canvassing, it would be obviously unfair to expect him to give away too much information. However, he will reveal one sure way of getting a consumer.

You may talk for hours on the advantages of electricity in the home, and you will fail to convince, but just casually mention that the people at No. 19 are going to have it, and——

"Mrs. Jones, she's going to have it in, where's she getting the money from? she's head over heels in debt, but if she's going in for it, we will."

You will carry away a signed application form.

As canvassing is generally done during the day, only the women-folk are about, and then you will learn what man really is.

In the correspondence course on canvassing, a lesson on the art of handling babies will surely find a place. Sooner or later the canvasser will have to hold baby while mother is reading the application form, and if baby cries——

It is such matters as these that decide whether applications be lost or won. A word of warning—never ask what they call "IT." This is a mortal sin.

One women invited the writer to view a new fireplace she had just installed, and the following one-sided conversation ensued:—

"You know, I didn't like the old wooden one, and so I had this put in. I did it all myself. I didn't let my husband have anything to do with it. Of course, I took him with me when I chose it. I didn't want him to be left entirely in the cold. But I did it all myself; I even sold the old one."

Most people are fully aware of the value of electricity in the home, and the only difficulty is the cost of con-

rersion. Some have heard weird tales of mysterious fires caused by fuses, as per daily Press reports, and it is to be hoped that the publicity work of the E.D.A. will be backed by local effort.

The quality, or lack of quality, of the gas is a source of bitter and constant complaint. In fact, it has given birth to more humorists than either prohibition or mothers-in-law, and the writer thinks that more people change over because of the badness of the gas rather than the goodness of electricity.

One kindly gentleman offered to install one light, "just to help the main into the street." He asked a contractor to quote him for the installation, and on receiving a polite refusal urged him "to come along and see the missus, and if you talk to her we may have two."

Sensible questions are asked regarding electricity for domestic purposes, and if the authority hires irons, most people eagerly take one.

In the foregoing paragraphs the writer has faithfully recorded some experiences of canvassing. It is an interesting job, and much may be learned of human nature; in fact, it is embarrassing sometimes to have to listen to personal details.

The writer will close with some advice.

It was suggested to him, in his salad days, that once a door was opened, to keep it open insert the foot. Don't!

"BALL LIGHTNING."—AN EXPLANATION.

By E. KILBURN SCOTT, M.Inst.E.E.

From time to time one sees in the daily Press, and occasionally in scientific journals, circumstantial accounts by people who say they have seen a ball of fire, or globular lightning as it is called. Occasionally the particulars are given in considerable detail by observers who have scientific knowledge, and also by others who are not given to imagining or exaggerating what they see. It seems to me, therefore, that the attitude of pooh-poohing the matter and saying that it is merely an optical illusion is not justified; the accumulation of evidence is much too great for that.

After thinking about the phenomenon a good deal I have come to the conclusion that it can be explained in quite a simple rational way that fits in with well-known chemical and electrical facts. I believe that the ball is concentrated or possibly liquid nitric oxide gas, which has been made by a relatively short flash from a low-lying cloud to earth. Certainly all the observations fit in well with the formation and action of such gas.

We know that when air is passed through an electric arc flame in a large electric furnace, the nitrogen and oxygen combine to make nitric oxide gas, which, as it cools down, begins to take up more oxygen and form nitrogen dioxide. The process is quite well known to electrochemists, and in Norway, and elsewhere, plant has been running for many years which aggregates over half a million horse-power and makes nitrates from the air in that way.

We also know that when lightning strikes through the air it makes nitric oxide. That is one of nature's ways of fertilising the soil, and it has been estimated that 100 million tons of nitrogen fixed by lightning flashes fall annually on the earth's surface.

The energy suddenly released by a flash is enormous, and the pressure has to be millions of volts so as to tear a way or a hole through the air dielectric. I expect that momentarily a very high pressure is set up, immediately followed by a reaction which gives a sudden chilling effect. If that be so, then the conditions are extremely favourable to the production of a large amount of nitric oxide gas in a very concentrated and probably liquid form.

Lightning is of two kinds, namely, flashes between a cloud and earth, and flashes between clouds. When the first occurs the cloud has first to come relatively close to the ground, and that is why there is darkness just before a storm, also the most violent flashes occur before the rain has had time to lower the tension by discharging it piecemeal by raindrops.

Assuming that highly concentrated or liquid nitric oxide gas is rolled up as it were into a ball by such a lightning flash, then owing to its density it would gravitate slowly downwards in exactly the way that observers say they have seen. Whilst doing so, the outer layer of the gas will be gradually oxidising to nitrogen dioxide, and this will dissipate in the air, and if the length of travel through the air is long enough, it will all disappear in that way. Occasionally, however, the ball of gas starts to fall from a point so near the earth that some of it is still in the form of a ball of concentrated nitric oxide when it arrives at earth level.

If it meets with some organic material, such as a haystack or a tree, which it can nitrate, we know exactly what should happen, because that is one way in which explosives are made. The nitrating and the explosion would take place practically simultaneously, for when liquid nitrogen dioxide comes in contact with organic matter it produces a most violent reaction. One of the worst accidental explosions during the war was caused in just that way.

I have hesitated for some time before putting forward this theory in the Press, but am encouraged to do so now by its favourable reception by some distinguished friends in the electrical and chemical engineering professions.

Super-Power Conference in the United States.—Half a million dollars and 50,000,000 tons of coal could be saved every year by electricity users of eleven North-Eastern States on an investment of 1,250,000,000 dollars, Mr. Herbert Hoover, Secretary of Commerce, told a "super-power" conference of public engineers of the eleven States on October 13th.

By developing easily accessible water power, he said, and by linking into a vast network of distributing cables the existing electricity producing stations, more power could be developed, more cheaply, and with a more even dependable flow to the users.

Mr. Hoover assured delegates to the conference, which had been called with the approval of President Coolidge, that it was intended as a preliminary discussion of steps federal and State authorities might take in promoting super-power development in New England and Mid-Atlantic States. "Engineering science has brought us to the threshold of a new era in the development of electric power," he continued, "an era that promises great reductions in power cost and wide expansion of its use. We can now undertake the cheaper sources of power from water sources farther afield, such as the St. Lawrence, and cheaper generation from coal by larger and more favourably placed generating plant."

States could assure themselves of more economic electricity, of a more dependable supply, and of more security from the effect of coal strikes if they would join in producing and distributing electric power, he said. Groups of States were associated in networks of inter-connecting power distributing lines, he pointed out, but lack of protective legislation, federal and State, stood in the way of rapid and complete development of the "fluidity" of power, and that was the immediate problem he asked the delegates to consider.

On the suggestion of Mr. Hoover, it was decided to hold another conference within a month or six weeks to formulate more definite plans of bringing about the co-operation of the public utility companies and removing the obstacles caused by the State boundary lines, which may have to be removed by treaties or compacts between the States.—*Reuter's Trade Service* (New York).

THE "DUPLEX-MONO" GAS ANALYSER.

THE use of CO_2 recorders in boiler installations has become a general practice, but the recording of the CO_2 in the flue gases does not indicate when incomplete combustion is taking place. The losses in this case may be greater than when there is an excess of air in the flue gases. Only by systematically checking the quantities of the combustible gases as well can control be properly exercised.

The "Duplex-Mono" recorder (fig. 1) has been designed for this purpose. This instrument automatically makes and records thirty gas analyses per hour, recording CO_2 and combustible gases (CO, CH_4, and H_2) alternately, thus indicating continually to what degree economical combustion is being attained.

The construction of the apparatus is illustrated in fig. 2, and the operation is briefly as follows:—

The gas sample is taken from the place where the most characteristic sample can be obtained through the ¼-inch sampling tube and then through a special filter which removes all suspended matter and moisture, thus obviating the possibility of the piping to the instrument choking, or water-traps forming. The gas then passes through a copper pipe ¼-inch in diameter to the instrument; this sample is taken, and driven, through the instrument by a mercury pump of special design which is an integral part of the apparatus and is operated by either water or compressed air, the pressure required being not less than 8 lb. The gas is drawn from the flue by the suction stroke of the mercury pump into a volumeter which on the pressure stroke accurately measures the sample, after which it is forced through an absorption tank containing caustic potash, where the CO_2 is absorbed. The residue passes into a measuring bell, floating in glycerine, which, as the gas passes into it, rises and turns a balanced wheel, which, through a pin, actuates the pen wheel. This, in turn, operates the pen and causes it to draw a line on the chart indicating the percentage of CO_2.

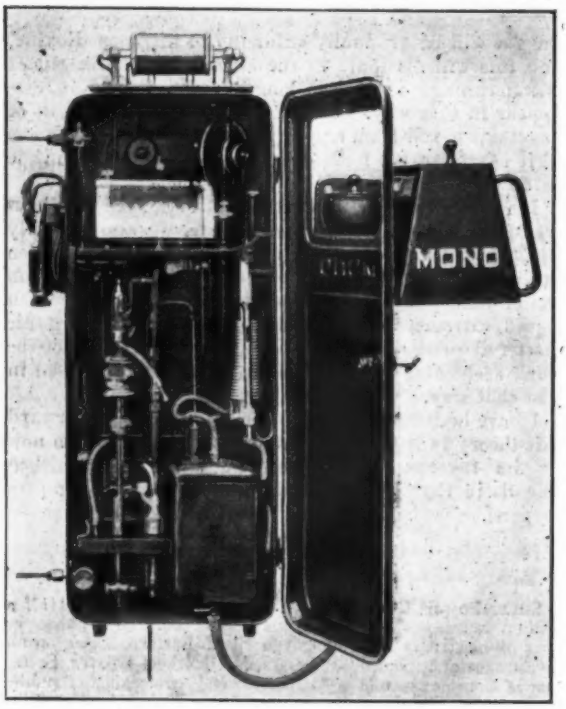


FIG. 1.—THE "DUPLEX-MONO" GAS ANALYSER.

When the mercury pump has completed its pressure stroke its suction stroke commences, and the measuring bell is put in communication with the atmosphere, and ejects by its own weight the residual gases, whereon the pen returns to zero. On the next stroke of the mercury pump the gas is drawn in as before but diverted by a directing valve (also operated by the water pressure) after being measured in the volumeter, and passed through a small electric furnace where the combustible gases are burnt to CO_2 and water vapour, in the presence of copper oxide, which supplies any required oxygen and also acts as a catalytic agent; from this furnace the gas passes through the absorption chamber where the water vapour and the total CO_2 (the original CO_2 in the flue gas and the CO_2 formed by the complete combustion in the furnace) is absorbed, and the residue measured in the measuring bell and the total percentage of CO_2 and combustible gases registered on the chart.

Owing to the special design of the gas filter the pipes cannot choke, and in consequence the maintenance is negligible. The gasometer being cooled by a coil in which the operating water circulates, and the rest of the tubes being kept at the same temperature by the mercury which is also in constant contact with the water, the gas before analysis, in the volumeter, and after analysis, in the measuring bell, is always at the same temperature, thus the measurements are extremely accurate. The instrument is supplied with a two months' chart, self-filling pen, and with a special filling device for replenishing the caustic potash in the absorption tank; as well as a filter for filtering the operating water before admission to the instrument.

The "Duplex-Mono" control shows at once the most efficient way of handling the stoker and the draught, whether the fuel bed is too thick or too thin, whether the proper fuel bed level is maintained, whether the fires are clean or dirty, whether the primary and secondary draughts are properly proportioned, &c., and thus a check is kept on all shifts. The control also shows if proper mixing and combustion of the fuel and air can be obtained by the present firing methods and draught regulation, and if better conditions in this respect can be obtained by altered fire brick structures in the combustion space, such as piers on the bridge wall, or by deflecting arches or wing walls.

The apparatus is manufactured by MESSRS. JAMES GORDON AND CO., LTD., London.

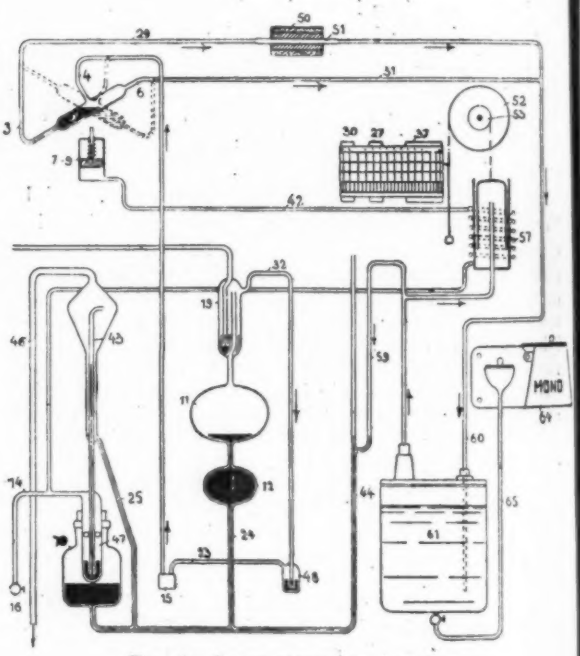


FIG. 2.—CONSTRUCTION OF ANALYSER.

3—Connection from directing valve to furnace lead.
4—Connection from directing valve to volumeter lead.
6—Connection from directing valve to absorption tank lead.
7-9—Directing valve cylinder and piston.
11—Volumeter measuring chamber.
12—Volumeter lower chamber.
13—Mercury bottle.
14—Water pressure pipe.
15—Water trap.
16—Regulating valve.
19—Top mercury seal.
23—Connection between lower mercury seal and water trap.
24—Volumeter lower pipe.
25—Compression tube mercury drain.
27—Drum carrying chart.
29—Pipe line from directing valve through furnace to absorption tank.
31—Pipe line from directing valve to absorption tank.
30—Drum carrying chart.
32—Lower mercury seal tube.
37—Clock drum.
42—Water connection to directing valve.
43—Compression tube.
44—Stop tube.
46—Water discharge to waste.
47—Compression tube mercury reservoir.
48—Lower mercury seal.
50—Electric furnace.
51—Combustion tube.
52-53—Pen operation wheels.
57—Gasometer and measuring bell.
59—Stop tube connection to absorption tank.
61—Absorption tank.
64-65—Filling device.

Standardisation of Electrical Details for Motor Vehicles.—The Standards Department of the Society of Motor Manufacturers and Traders is proceeding with the following subjects:—Battery crates or trays, dynamos and starting motors, switches (other than for commercial motor-vehicle use), magneto couplings, the Bendix drive, and self-starter sprockets.

ELECTRICALLY-EQUIPPED HOMES.

On October 20th, the Duke of Connaught formally opened the Hackney Memorial Homes for disabled soldiers and sailors, comprising six cottages and four self-contained flats, in the presence of a large company. These dwellings are of interest owing to the adoption of electricity for many purposes.

Fig. 1.—Bedroom Fitted with Electric Lamp and Fire.

The electrical installation was carried out by the sales department of the Hackney Electricity Undertaking, the buildings being wired with C.T.S. cable for lighting, cooking, heating, wash copper, and hot-water apparatus.

Fig. 2.—Exterior of the Homes, showing Scarcity of Chimneys.

The lighting installation in each of the tenements comprises seven pendants with 10-in. opal shades and lamps. The wiring is divided into two circuits, with a two-way distribution fuseboard and a d.p. main switch and fuses at the meter.

Fig. 3.—Kitchen Fitted with Electric Cooker and Copper.

The cooker is a standard small floor type "Tricity," as hired out by the electricity department, with a three-pint, quick-boiling kettle, the latter being connected to a socket at the cooker position.

The heating installation comprises three Santon switchplugs in the three bedrooms, and one 2,000-watt fire of the "Hackney" pattern.

The wash copper is of 10-gallon size with a loading of 2,000 watts, and is controlled by a three-heat switch locally.

The hot-water apparatus consists of a "Genii" immersion heater, with a loading of 2,000 watts, fitted into a 20-gallon hot-water tank in each tenement, and locally controlled by a d.p. switch. Provision has been made for installing thermostatic control, which may be done at a later date. The tank has been lagged with an asbestos jacket.

The only fireplace is situated in the living room, which is fitted with an "Interoven" type of stove with hot-water circulation to the 20-gallon tank. The electrical heating of the water will be used when desired in conjunction with the circulating system, and exclusively throughout the summer months.

The supply to each tenement is given by a separate service with two prepayment shilling-in-the-slot meters. One of these meters is arranged for lighting at 8d. per unit, and the other for cooking, heating, copper, and hot-water at 1½d. per unit.

The photographs here reproduced were taken by Mr. W. Selfe, of Clapton.

LEGAL.

Chamberlain & Johnson v. Gwalchmai Electricity Supply Co.

On October 19th, according to the *Liverpool Daily Courier*, judgment was given for plaintiffs in an action under a writ of elegit, dating as far back as the thirteenth year of Edward I, at a Sheriff's Court at Holyhead, before Sir Chas. McIver, High Sheriff of Anglesey, and a jury.

Mr. R. G. Roberts, acting for Messrs. Chamberlain and Johnson, Llandudno, explained that the Gwalchmai Electricity Supply Co. owed £257, including interest to date. The plaintiffs were Mr. E. S. Lance, electrical engineer, Llandudno, and Mrs. Ellen Parry, widow, Menai Bridge.

Judgment had been entered at the Bangor Registry for the plaintiffs, but the defendant company had not been able to meet its obligation. It was a public undertaking, and the plaintiffs said that the company had land, machinery, and plant, and the plaintiffs asked for possession of those things until such time as the amount due was paid. The public would thus not be deprived of their light.

Evidence was given by Mr. Lance that he was one of the original promoters of the company, which was formed in 1917. He sold his interest in the company, and there was a balance due to him of £248 and interest.

Mr. A. Preston Thomas, auctioneer and valuer, Holyhead, estimated the value of the property at £300, and the annual value at £30.

The Under Sheriff said the jury had no doubt come to the conclusion that the plaintiffs were entitled to judgment, and it was therefore their duty to make an order to invest the property in the plaintiffs.

The jury found accordingly.

Brighton Corporation v. Clayton and Oakley.

On October 23rd, before the Brighton magistrates, Adela Clayton, of Marine Parade, was summoned for causing electricity to be diverted and thereby stealing the same, and Ernest Oakley, of Montague Place, was summoned for aiding and abetting. For the Corporation it was stated that Mrs. Clayton had two meters—one for light and one for power. Both meters were inspected in August last, and the lighting meter had registered nothing since June 4th, although the electric light was burning in the hall. The inspector found in the housekeeper's room in the basement an attachment connected by a plug in the floor to the electric light in the ceiling. The result of that attachment was that Mrs. Clayton was receiving her light through the power meter. The supply was cut off on August 24th, and on August 27th Mrs. Clayton went to the electricity offices where she was questioned. She then said: "Yes, Mr. Oakley put me up to it, and showed me how it could be done."

Mr. G. T. Joyce, assistant manager of the Electricity Undertaking, stated that the charge for electricity for light was 5d. per unit and for power 1½d. per unit.

Mr. Neve, for the defence, submitted that on the grounds of larceny he had no case to answer. No electricity, he said, went into the house without it having been recorded on a meter. Mrs. Clayton might have changed the rate, but that was not a criminal offence. It was a civil offence for which a claim for damages might or might not be brought.

The magistrates ruled against this contention.

Defendants pleaded not guilty.

Mrs. Clayton said she first went to see Mr. Oakley about the beginning of June about an electric iron which she took to be repaired. In the course of conversation Mr. Oakley suggested that she should have a power meter. He subsequently gave an estimate, and did the preliminary work, and the Electricity Department fixed the meter. Afterwards Mr. Oakley or his man came again and fixed the attachment described by Mr. Graves. She did not ask Mr. Oakley to do that, and she was not told that by using it she was

defrauding the electric light undertaking. She had no idea that she was doing such a thing. When the meter reader came on August 23rd and told her the attachment was wrong, she went to Mr. Oakley, who sent a man who took it down. Witness put the attachment away and never used it again. She admitted to Mr. Joyce on August 27th that she knew she had been doing wrong on the advice of a friend who went with her and said that if she made such an admission, the light, which had been cut off, would be restored. She understood also that no proceedings would be taken.

Mr. Oakley said he carried on business as a cutler and electrician at 18, Montague Place. He said he gave Mrs. Clayton an estimate in June for putting two plugs "in a little room downstairs," and he sent an electrician who worked for him to do the work. Only two plugs were put in. There was no attachment. He charged £2 10s. for the work, and gave 5s. discount. On August 23rd Mrs. Clayton told him there was something wrong, and he sent a man to see what was the matter. He denied that he supplied the attachment connecting the electric lighting installation with the power meter. He was not an electrician himself.

After consulting in private, the Chairman said the magistrates had come to the conclusion that there was a shadow of doubt as to what Oakley's intentions were, and he would be given the benefit of that doubt and discharged. "I would like to say," added Mr. Saunders, addressing Oakley, "that as you call yourself a cutler and locksmith, it is very dangerous for you to dabble with anything you don't understand."

Addressing Mrs. Clayton, the Chairman, in imposing a fine of £10, with the alternative of 21 days' imprisonment, said the magistrates looked upon it as a serious matter, and thought she knew more about electricity than had been made out.

Brisbane Tramway Litigation.

The following statement appeared in the *Financial Times* on Monday last:—

"The Brisbane Electric Tramways Investment Co. announces that the Full Court of Queensland gave a majority judgment on August 28th that the purchase money for the tramways undertaking is to be determined in accordance with the decision of the House of Lords in the cases of the Edinburgh and London street tramways. Instructions for an appeal to the Privy Council have been given, but the case can hardly be heard before the middle of next year."

British Thomson-Houston Co., Ltd., v. Saul Fish.

In the Chancery Division, on Friday last, this motion, adjourned from October 12th, was disposed of. Plaintiffs claimed an injunction restraining defendant from infringing their half-watt lamp patents.

Mr. Trevor Watson (for the company) said Mr. Moritz (for defendant) had consented to treat the motion as the trial of the action, and would submit to the usual order in an action for an injunction.

Mr. Justice Romer made the order as asked.

Fire Prevention.—The report of the Royal Commission on Fire Brigades and Fire Prevention, recently issued, states that out of some 19,000 fires in the year 1919, 649 were due to electricity, 668 to gas, and 383 to oil, in lighting applications. The annual direct loss of property due to fires is estimated at £12,000,000. The use of automatic fire alarms is commended, and three electrical types are named in the report, the patent rights of which are owned by Associated Fire Alarms, Ltd. It is stated that the maintenance of these alarms has since 1911 been retained in the company's hands, and that in the period 1911-1920 the fire loss in premises so protected was less than 3 per cent. of the premium income, as contrasted with 50 per cent. in the case of ordinary risks. After making due allowance for other circumstances, the report states that "there can be no reasonable doubt that, on premises protected by automatic alarms efficiently superintended and maintained, the risk of any serious loss from fire is very materially reduced." The allowance for these alarms made by the "Tariff" companies is from 7½ to 12½ per cent., but it is stated that the Birmingham Chamber of Commerce, the National Union of Manufacturers, and other bodies have suggested that an allowance of 25 per cent. should be made, and the report states that the representatives of the insurance companies aver that they are prepared to give careful consideration to the matter. The Commission suggests that the London County Council should give further consideration to the question of permitting direct connection of the alarms with the nearest fire brigade stations, which is not at present allowed in London.

The *Pall Mall Gazette*, in reviewing the report of the Chief Officer of the London Fire Brigade for 1922, stated that "of the total, 1,148 calls were due to fires caused by defective electric circuits"; the Chief Officer, however, actually said that "Of the false alarms. . . . 1,148 were due to defective electric circuits." No actual fires were concerned, and the garbled version above mentioned constitutes a gross libel on electricity.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are incited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Large Transformer Kiosk.

Messrs. Hardy & Padmore, Ltd., of Worcester, have produced the new large transformer kiosk illustrated in fig. 1. This is 6 ft. wide and 3 ft. 2 in. deep inside. It has large door openings at the back and front, each measuring 8 ft. 4 in. by 5 ft. 3 in. clear. Each of these openings is closed in by four doors provided with shooting bolts secured by a special locking device. The base, which goes below the ground level, is 1 ft. 6 in. high, and the size of its bottom flange is 6 ft. 10 in. by 3 ft. 11 in. overall. The kiosk has a mild-steel plate floor, and it weighs approximately 55 cwt.

Fig. 1.—A Large Transformer Kiosk.

Wind-driven Lighting Sets.

The Glasgow Electrical Engineering Co., Ltd., 45-47, Pitt Street, Glasgow, has sent us particulars of its "Apex" automatic self-regulating wind dynamos. A typical installation is illustrated in fig. 2, from which it will be noticed that a very simple mast is employed with anchored guy ropes. This mast is usually 30 ft. high, and mounted upon it is an 8-ft. diameter wind-wheel and the dynamo driven through gearing. The dynamo has an output of 400 W at a pressure of 25 V. A pressure of 50 V is arranged for in cases where the plant is fixed at some distance from the buildings to be supplied. An adaptation of the equipment consists of the head portion alone, mounted on struts, for fixing upon existing towers, roofs, or other suitable structures (see fig. 3).

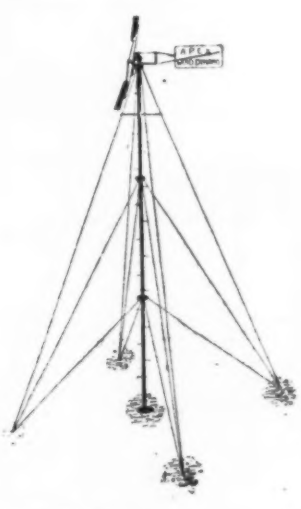


Fig. 2.—Wind-driven Lighting Set.

Fig. 3.—Adaptation of Set for Roofs, &c.

An adequate battery (15 or 100 Ah) is supplied, together with a switchboard fitted with an automatic cut-out, instruments, &c. The set is arranged to commence generating with a 6-m.p.h. wind, reaching its full output with a 25-m.p.h. wind.

The firm makes a considerably larger plant, equipped with an 18-ft. diameter wheel, and giving an output of 3 kW.

The Dariment Primary Cell.

So much work has been done in the past in the search for the ideal primary cell that it is difficult to strike out a new line nowadays; the new Darimont cell, however, appears to be an exception in this respect. We understand that it is capable of giving a considerable current at a steady voltage for much longer periods than cells of the Leclanché type. The cell, which is due to Mr. L. Darimont, a Belgian engineer, is of the two-fluid type. It therefore has a porous pot, but diffusion between the two liquids is practically negligible, for the reason given below. The plates are of carbon and zinc, and the liquid depolariser round the carbon consists largely of ferric chloride; the electrolyte around the zinc con-

Fig. 4.—The Darimont Primary Cell.

sists of a paste or viscous emulsion made up with sodium chloride, calcium carbonate, and other materials, so that the electrolyte is always maintained neutral. Consequently, local action is practically non-existent, and the electrolytic consumption of the zinc during the action of the cell is extremely uniform. Diffusion is prevented by the formation of a semi-permeable membrane at the surface of contact between the two fluids in the pores of the porous pot. Notwithstanding the fact that the cell is a two-fluid one, it can be used not only to give small currents continuously, but also to give inter-

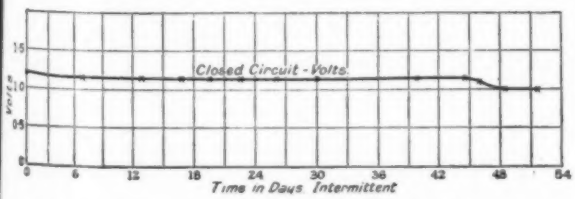


Fig. 5.—Output Curve of the Darimont Cell, Type T.15.

mittent currents for long periods. From tests made by the National Physical Laboratory, it appears that the open-circuit e.m.f. is about 1.5 volts, and the internal resistance varies very little during discharge. There is no smell, no crystallisation of salts, and the chemicals used are not dangerous or objectionable in any way. The cell is easily recharged, and the paste and depolariser are supplied in appropriate quantities for this purpose.

Such a cell should find considerable application for such work as railway track signalling, wireless telegraphy, telegraphs and telephones, burglar alarms, testing laboratories, emergency lighting, &c. Fig. 4 is a view of the cell in a glass container, and fig. 5 shows how the terminal voltage is maintained in the case of the T.15 type, when giving an intermittent current of 0.75 ampere for two hours daily. For working radio valve sets a current of this value is frequently required for heating the filament, and so far accumulators have been largely used for this purpose. In many localities, however, the charging of accumulators presents difficulties, and a reliable, easily managed primary battery would be welcomed.

The battery is being made in various sizes by Darimont Electric Batteries, Ltd., of 536, Salisbury House, London, E.C.2.

Daysohms a.c. Arc Welder.

An instructive demonstration of Daysohms low-pressure a.c. "Utility" electric arc welder was recently given by the Paragon Electrical Co., of 56, Victoria Street, Westminster, S.W.1. The appliances, to the early models of which some reference has already been made in our pages, are manufactured in two sizes, known as the "A" type (capacity from 25 to 150 amps.) and the "B" type (capacity from 25 to 80 amps.), and will fulfil the majority of ordinary requirements.

The machines are designed to work on ordinary a.c. supply circuits, and take a maximum of about 5 and 10 kVA respec-

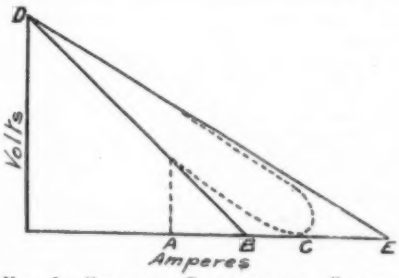


Fig. 6.—Composite Characteristic Curve.

tively at 65 volts from the mains, and are particularly useful in manufacturing and repair shops of all descriptions. A special feature of this type of low-pressure a.c. welder is the fact that, owing to its being possible to set the striking and welding currents independently, and to the keeper being free to move between the stops against the control of a dash-pot, a composite characteristic curve is obtained, which is the resultant of the two curves that would have been obtained if the keeper had been fixed in either position, as shown in the accompanying diagram, fig. 6. The curvature can be varied by regulating the speed of the dash-pot by means of perforated disks on the plunger. The result is that welding can be done with a lower open-circuit voltage, and it is

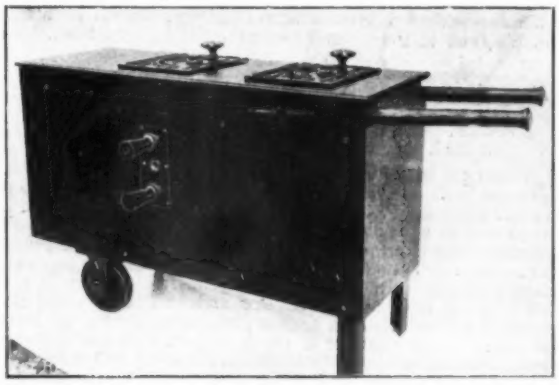


Fig. 7.—Daysohms a.c. Arc Welder.

also possible to weld thinner material without burning through it, owing to the striking current being set very little in excess of that required for welding.

Considerable commercial work has been done on 19 and 20 gauge metal, and it is claimed that twice as much is deposited when using this machine on a.c. mains, as is done when using a motor generator on the d.c. mains for a given consumption of electricity—in other words, for each lb. of metal deposited the cost of electrical energy is halved—due, in part, to the fact that in using a static transformer instead of a rotating machine, the losses of conversion are much reduced; a further advantage is that there is practically no wear and tear, and weight and capital cost are enormously reduced.

The welder consists of a single unit complete in itself, ready for connecting directly to the a.c. supply mains, and is embodied in a teak case provided, in the larger size, with wheels, as shown in fig. 7, and in the smaller size with two pairs of handles, so that it is portable.

E

REVIEWS.

Vector Analysis. By C. Runge, translated by H. Levy, M.A., D.Sc. Pp. 226; 36 figs. London: Methuen & Co., Ltd. Price 9s. net.

In these days, the advance of engineering in many directions makes it necessary to call upon the physicist or the chemist for the solution of numerous problems in the sphere of mechanical science. The engineer who is engaged in promoting this advance must himself know sufficient of the pure sciences to formulate his problems in such terms that the scientist can employ his special equipment for their solution.

Similarly, the worker in pure experimental science is often compelled to call in the aid of his mathematical colleague in order to provide general solutions for the complex relationships with which he may be dealing. The worker in experimental science must, however, know sufficient of the mathematical tools used by his *confrère* to enable him to state his problem in a form which is capable of mathematical solution.

The principles of vector analysis, as presented in the present volume, form primarily part of the equipment of the mathematician, but the worker in experimental science must know at least the elements of these principles. They are presented here in a logical and handy form, which is yet complete enough for the serious student of mathematics.

The great works of Hamilton form the basis on which the more recent mathematicians have based their studies of quaternions and generalised vector analysis. Tait, Joly, and Gibbs are amongst those who have contributed towards converting the method of quaternions into a practical branch of mathematics suitable for employment in problems of physics. Each of these writers effected some simplification of method or notation. The book before us, which is based largely on the work of Grassmann, seems to have succeeded in advancing still further in the direction of a simplified notation and in avoiding elaborate proofs and laborious methods.

The author's style is extremely terse, but his method is lucid, and the three chapters which the book contains give a complete and logical treatment of the vectorial analysis of three dimensions. A second volume is promised, which will deal with the analysis in four and more dimensions which has an important bearing on the theory of relativity.

The first chapter deals with vectors and vectorial areas, and includes the treatment of scalar products, vectorial products, and external products of vectors and vectorial areas.

Chapter II is devoted to the differentiation and integration of vectors and vectorial areas, while in the third chapter are considered the affine transformation of space and tensors.

While it may be true that few electrical engineers will be called upon themselves to apply the more highly abstract of the mathematical methods of vector analysis to their own problems, yet there are a few inquirers who will feel the need of some insight into this very important branch of mathematics, and to them we commend Prof. Runge's book.

Experimental Electrical Engineering and Manual for Electrical Testing. By Vladimir Karapetoff. Vol. I, 3rd edition. Pp. xxxii+795; 391 figs. London: Chapman and Hall. Price 30s. net.

This new issue of a well-known text-book of laboratory practice will be made welcome in this country, where its earlier editions have already made many friends. The original work was in a single volume; but subsequent extensions have increased the size until we now have a first volume comprising more than 800 pages, to be followed by a second one on a similar scale. Although written primarily for the use of students, it is clear that its size and cost must make it a work of reference rather than a personal possession for many students. On the shelves of any important electrical engineering laboratory or test-room it should, however, find a place.

Prof. Karapetoff's book differs from some of the manuals on electrical testing which are extensively used in this country in having primarily the needs of the engineering student in view, so that a certain proportion of the tests described are definitely educational in aim. At the same time, some parts of the work are intended specifically for the practical engineer, and not for the student.

The present volume contains descriptions of about 200 experiments covering a very wide field of electrical engineering, though the greater part of them are concerned with electrical instruments and electrical machines. Clear instructions and diagrams of connections are given, though examples and data of actual results are not generally included. While the principles underlying the experiments are clearly and adequately stated, there is no attempt made to give the mathematical theory of the apparatus or machine which is the subject of the test. Thus, the book is a laboratory manual merely, and not a general text-book of electrical engineering. It is hardly necessary to say that it is extremely thorough and complete as a guide to the experiments on the ground which it covers. The choice of experiments in this volume is determined by the author's decision to put the more elementary experiments into the first volume and to make the second volume suitable for the needs of advanced students. While this arrangement is advantageous from the students' point of view, it makes the treatment of many topics appear incomplete without the complementary volume. This is particularly the case in the tests on alternating current machines, since only the more elementary experiments are included, and tests on the rotary converter and motor converter are not given at all. Experiments on a.c. commutator motors are excluded from the present volume; but the same impression of incompleteness is not produced by the entire relegation of a special and distinct type of machine to the second volume.

It is not easy to give a summary of the contents of such a large volume in a small space, but it may be useful to those not already familiar with the previous edition of *Experimental Electrical Engineering* to give some indication of the ground covered in this volume.

After a chapter dealing with the measurement of resistances, treated from the point of view of obtaining the best results under a variety of practical conditions, rather than from the academic aspect of the theory of the measurement, there follow two chapters on ammeters and voltmeters, their construction and calibration. Then wattmeters, power-factor meters, and energy meters are dealt with in a similar practical manner. The next two chapters are mainly of educational interest, and deal with reactance and resistance in a.c. circuits and the magnetic circuit. After this come measurements of permeability, hysteresis, and core losses.

The next chapters deal with the ordinary forms of test which can be carried out on d.c. machines, transformers, alternators, and induction motors. These are dealt with in a very clear and practical manner. The contact drop between the brush and commutator of a d.c. machine seems to have received less attention than it deserves, and the split-brush method of studying the interpole field is not included.

Primary cells and storage batteries come next, and a great deal of useful and practical information is included as to the operation and testing of both lead and nickel-iron types of storage cells.

After a useful chapter on motor starting and controllers, we reach the final four chapters devoted to the Elements of Telephony, Intercommunicating and Magneto Telephone Systems, Control-energy Telephone Systems, and Telephone Lines.

In conclusion, it may be said that a most pleasing characteristic of the book is that the author thinks always of the purpose and methods of carrying out the tests in the best way to obtain the required results. This contrasts with the point of view of many writers, who are mainly interested in the theory of the experiment and pay only secondary attention to the application to practical results and details of experimental procedure.

Radio-Telegraphy and Telephony. By E. W. Marchant, D.Sc., M.I.E.E. Pp. ix+137; figs. 51, and illustrations. London: Hodder & Stoughton, Ltd. Price 6s. net.

This book describes briefly, without mathematical expositions, the principles of radio communication and their present applications. The author, who is a well-known authority on the subject, sets out "to enable anyone with a slight knowledge of electricity to understand what is happening both at the sending and receiving ends, when he hears a radio message," and if this "anyone" cannot do so it is certainly his own fault.

The whole ground work is covered clearly and concisely in 117 pages, the author being as happy in selecting what should be omitted as what should be included, and the information given is right up to date, a matter of great importance in a subject which is developing so rapidly.

The arrangement of the book is excellent. The first two chapters deal with electric waves and high frequency currents, the next two with transmission and reception in general, the next four with modern methods of transmission and reception, and the last three with directional signalling, long range signalling and variations in signal strength.

A useful index and glossary of terms are included.

Radio and High Frequency Currents. By Edgar T. Larner. Pp. viii+56; figs. 22, and 5 plates. London: Crosby Lockwood & Son. Price 3s. 6d. net.

This little book is an introduction to the theory of radio-telegraphy and telephony, and is suitable for an electrical engineer whose work lies in other applications of electrical science, but who wishes to understand the fundamental principles of radio signalling without spending the time required for the study of fuller text books.

The information given is accurate and up to date, divided into four chapters, headed "Electric Waves," "Capacitance and Oscillations," "Reception and Transmission."

Central Heating in Canada.—Mr. F. A. Combe, of Montreal, chairman of the Fuel Committee of the Engineering Institute of Canada, has been appointed by the Government to investigate and report on the feasibility of establishing central heating plants in Canadian cities. The investigation will be under the supervision of the Dominion Fuel Board, and will include the possibility of combining the electricity generating and heating services with a view to the solution of the fuel problem and more economical heating.—*Reuter.*

BUSINESS NOTES.

Bankruptcy Proceedings.—E. W. J. Whitelock, electrical engineer, 4, Leagrave Road, Luton.—Trustee, Mr. T. Keens, 11, George Street, Luton, appointed October 23rd.

H. Farnell, plumber and electrician, 183, Higher Hillgate, Stockport.—Last day for proofs for dividend, November 10th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

F. B. Thorpe, electrical engineer, 1, West Laithe Gate, Doncaster.—First meeting, November 7th, at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, November 15th, at the County Court Hall, Sheffield.

T. S. Cartwright (T. S. Cartwright & Co.), electrical contractor, 90, Wellington Street, Stockport.—First and final dividend of 8¾d. in the £, payable November 7th, at the Official Receiver's office, Byrom Street, Manchester.

Dissolutions of Partnership.—Morris & Playne, electrical engineers and contractors, 43, George Street, Plymouth.—Messrs. E. D. Morris and A. C. Playne have dissolved partnership. Mr. Playne will attend to debts.

London Fan & Motor Co., 81, Charlotte Street, Tottenham Court Road, London, W.1.—Messrs. G. J. D. Hartigan and J. A. Hartigan on the one part, and Messrs. C. H. Roberts and D. G. E. Barrie have dissolved partnership. The business is being carried on by Messrs. Hartigan, who will attend to all liabilities. It has been transferred to the above address, "Museum 3627."

Wagers, electrical engineers, 552b, Coventry Road, Small Heath, Birmingham.—Messrs. E. G. Faithorn and Mr. A. J. Wager have dissolved partnership. Mr. A. J. Wager will continue the electrical engineering department, and Mr. E. G. Faithorn will continue the wireless department.

Company Liquidations.—British Industries Fair, Birmingham (Incorporated).—Particulars of claims by November 30th to the liquidator, Mr. H. Wright, 95, New Street, Birmingham.

Bootle Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. Hodgson, 70, Central Buildings, 41, North John Street, Liverpool. Meeting of creditors at the Liquidator's offices, November 13th. Particulars of claims by December 13th.

Charles Fer & Co., Ltd., 42, Newgate Street, London, E.C., also trading as the Domestic Electrical Appliances Co., at 267a, Finchley Road, N.W.3; 24, Market Place, Reading; 74, Prince of Wales Road, Norwich; and 14, Queen Street Arcade, Cardiff.—A meeting of the creditors of the above was held on October 30th, at the Institute of Chartered Accountants, Moorgate Place, E.C. The chair was occupied by Mr. S. P. Child, of Messrs. Trayton, P. Child & Son, C.A., 36/37, Queen Street, E.C., who had been appointed to act as the liquidator in the voluntary liquidation, and as receiver for the debenture holders.

The statement of affairs presented showed unsecured liabilities of £8,665, made up as follows: Trade creditors, £1,591; cash creditors, £900; creditors for rent, &c., £304; and unsecured balance due to debenture holders, £5,870. The assets consisted of: Furniture, fixtures and fittings, £263, estimated to realise £67; stock-in-trade, £1,363, expected to produce £570; book-debts, £358, valued at £180; and leases, £70, making total assets of £887, from which had to be deducted £358 for preferential claims, leaving net assets of £530. The net assets were insufficient to meet the debentures, which totalled £6,400. There was a deficiency as regarded the debenture holders of £5,870, and consequently there was nothing available for the trade and other unsecured creditors.

Mr. Child said the position was a most unfortunate one for the creditors. Immediately on his appointment as receiver he advised that voluntary liquidation should take place. Considerable difficulty had been experienced in preparing the statement of affairs as the books were very imperfectly kept. He was afraid that under no circumstances whatever could the ordinary creditors expect to receive anything. The cash creditors advanced money last year, and in February of the present year. The preferential claims were chiefly in connection with the premises occupied by the company for the business of the Domestic Electrical Appliances Co. The company started as a wholesale concern, but finding the business unprofitable in 1921 it launched out into the retail trade. So far as the assets were concerned the stock was of a miscellaneous character and very difficult to realise. It appeared that the business was commenced in June, 1918, by Messrs. Paul and Charles Fer, at Mansion House Chambers, E.C. They started as agents for certain Continental firms in the electrical, aluminium, mathematical instrument, and brushware trades. During 1919 and 1920 profits of £200 and £900 respectively were earned. The premises at Newgate Street were taken in July, 1921. The business was purely wholesale until towards the close of 1921, when the retail establishments were opened. The company was formed on August 16th, 1921, with a nominal capital of £100, divided into 100 shares of £1 each. The present position was largely due to want of capital. Retail shops were opened in various towns, including Cardiff, Reading, Norwich, Liverpool and Newcastle. He was of the opinion that when the company was formed there was a deficiency of about £2,500. The debentures were created on February 21st last, but were not issued until July 10th. They were all issued for cash, but £4,000 could not rank before the unsecured creditors. The remaining £2,400, however, were quite valid.

In answer to Mr. E. Judd, of Corfields Traders' Association, the Chairman stated that the company never had any auditors.

A resolution was passed confirming the voluntary liquidation of the company, with Mr. Child as liquidator.

The following are creditors:—

	£		£
Affentranger Haas & Plattner	123	"Industrial India"	11
Amplifiers, Ltd.	12	Irradiant Lamp Works, Ltd.	32
Associated Newspapers, Ltd.	77	Johnson & Co., E.	70
Concordia Electric Wire Co., Ltd.	60	Metropolitan-Vickers Electrical Co., Ltd.	14
Condor Lamps (Great Britain), Ltd.	36	Marsel, Frank	13
Cottrell & Son, Chas.	17	Newman, Paynter & Co.	10
Daily Express Co., Ltd.	35	Perfecta Seamless Tube and Conduit Co., Ltd.	12
Edison Swan Electric Co., Ltd.	50	Plumstead, F. J.	13
Echstadt & Robert, Berlin	13	Sloan Electrical Co., Ltd.	35
Entwistle & Stephens, Ltd.	68	South African Engineering Co.	25
Eustone & Lilienfeld	25	Sullivan, H. W.	34
European & General Express Co.	14	Tavener, C., & Son	16
Electrix, Ltd.	20	Taylor Bros.	18
Forward Electric Co., Ltd.	13	Technical Publishing Co., Ltd.	33
Foyson, R. B.	21	Testard, H., et Cie.	21
General Electric Co., Ltd.	55	Verreries de St. Denis, S. A.	103
Hebmann et Fils, J.	195	Wooton, J. E., & Son	55
Hestavox, Ltd.	15	Whitehouse, W., & Co., Ltd.	38

Sanders, Kennedy & Co., Ltd.—Meeting of creditors November 14th at the Grand Hotel, Bristol. Liquidator, Mr. F. J. Scully, Bank Chambers, Bridgwater.

Receiver Appointed.—On October 19th, Mr. John Davie, of 3, London Wall Buildings, London E.C.2, was appointed receiver on behalf of the debenture holders of the Park Royal Engineering Works, Ltd. He is at present carrying on the business, and goods should only be supplied to his order.

Trade Announcements.—Messrs. James McMillan & Co., of Clun House, Surrey Street, London, W.C.2, have been appointed sole agents for Messrs. Sieverts Cable Works, Sweden.

Mr. S. Lovett, of Morley Road, Chadwell Heath, Essex, is extending his business so as to include electrical installation work, supplies, &c.

Messrs. Henry Joseph & Co., Ltd., have discontinued their agencies in Birmingham, Manchester, and Middlesbrough, and all communications should be addressed to them at 96, Victoria Street, London, S.W.

Messrs. Burchett & Edgecombe, of 31, Nursery Road, Chelmsford, ask for catalogues, &c., of electrical goods.

Mr. H. D. Denman, Western District representative of the Sloan Electrical Co., Ltd., now has an office and store at 70, Park Street, Bristol. Telephone No.: 5853.

Messrs. T. Wing & Son, electrical and general engineers, have taken over the business of Goodburn & Co., Clarendon Road, Broadstairs.

Messrs. W. H. Wilcox & Co., Ltd., announce that their new telegraphic and cable addresses are: Telegrams: "Enginsplys, Borch, London." Cables: "Enginsplys, London."

Messrs. Betts, of 4, Hopkins Street, Weston-super-Mare, who are shortly opening new showrooms at 11, High Street, in the same town, wish to receive lists of electrical novelties, small goods, wireless specialities and parts.

The Bagenalstown Electric Lighting Co. has now been registered, with the Very Rev. M. Cullen, P.P., Messrs. M. Sheill, G. Brown Donald, C. Cleary and T. P. Phelan as directors.

The title of the business of Messrs. S. P. Marsh, electrical engineers, of 63, Regent Street, Rugby, owned by Mr. F. Pritchard, A.M.I.E.E., has been changed to The Rugby Electrical Engineering Co.

The Electrical Trades Supply, Ltd., of Birmingham, ask us to state that Mr. H. Fraser, of Stratford-on-Avon, is not now representing them.

Catalogues and Lists.—Mr. George Ellison, Perry Barr, Birmingham.—List No. 323, containing an illustrated description of their totally-enclosed relay-type crane control panels.

Messrs. Adam Hilger, Ltd., 75a, Camden Road, N.W.1.—Leaflet descriptive of Dr. Müller's X-ray spectrograph for chemical, crystallograph and radiographic laboratories and for the general study of X-rays.

Messrs. P. L. Dwyer & Co., 30, Grosvenor Place, London, S.W.1.—November price list of wires and cables, conduits and conduit fittings and accessories; also a list of wireless sets and accessories.

Becco Engineering & Chemical Co., Ltd., 158-160, City Road, London, E.C.1.—Booklet No. 10 (8 pp.), describing their "Becco-Legg" pressure and gravity filters for water filtration.

Messrs. Markes, Ward & Co., Ltd., 30, High Street, Islington, N.1.—An illustrated and priced leaflet dealing with the "Mystery" radio receiver and variometers of different types.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, W.4.—Illustrated leaflet (List No. 155) describing

"Evershed's Wireless Generator," a source of high-voltage current for amateur and commercial radio work.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.1.—Publication No. 268B, of 52 pages, being an abridged edition of their catalogue of Sterling telephones for various classes of service, with prices brought up to date.

Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E.7.—Catalogue C.T.S.W., containing an illustrated description of their C.T.S. wiring system and accessories therefor.

Dariment Electric Batteries, Ltd., of 536, Salisbury House, London E.C.2.—List No. 1, describing the Dariment primary cell, with dimensions.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C.2.—Pamphlet No. 219, fully describing and illustrating their portable and semi-portable receivers; also an illustrated sheet (for insertion in pamphlet L198) showing their YB1 set, with wireless bell receiver and transmitter.

Book Notices.—"Better Times for the Housewife!—Labour's Policy for the Homemaker" is the title of a pamphlet by Mr. H. Morrison, of the L.C.C., which has been published by the Labour Party, price 2d. Mr. Robert Smillie, M.P., writes a preface warmly commending the author's work and emphasising the drudgery of a working woman's home life. Mr. Morrison sketches the daily routine, and proceeds to show how, by the use of electricity, the woman's burden can be lightened and labour lessened; he rightly holds that the electric service should be brought "within the reach of practically all working and lower middle-class families," and claims that as one of the objects of the Labour Party.

"Wireless Amateur's Diary and Note Book." Price 1s. "Wireless Experimenter's Diary and Note Book." Price 2s. 6d. "Wireless Telephony," by R. D. Bangay. Pp. viii+134; figs. 79. Price 2s. 6d. "Time and Weather by Wireless," by W. G. W. Mitchell. Pp. xii+125; figs. 66. Price 3s. 6d. London: Wireless Press, Ltd.

"Inspection and Testing of Materials, Apparatus, and Lines," by F. L. Henley. Pp. xi+255; figs. 151. London: Longmans, Green & Co. Price 21s. net.

"Mechanical Road Transport," by C. G. Conradi; pp. xvi+394; 188 figs. (Reconstructive Technical Series, edited by G. W. de Tunzelman.) London: MacDonald & Evans. Price 21s. net.

Lloyd's Register of Shipping—report of the society's operations for the year ended June 30th, 1923.

Steel Core Alcminium Cables.—Not the least important aspects of railway electrification are low capital cost, security of operation, and high efficiency. In the transmission and distribution of electrical energy to the motor equipment the combination of special high-tensile steel wire, with aluminium as the conducting agent, is claimed to give maximum efficiency at lowest cost. Mechanically, the catenary can be built equal to the standard methods adopted on overhead systems, while electrically, apart from the lower cost of the aluminium conductor, low-pressure insulated feeders are eliminated and the distribution of power throughout the system is more uniform. An eight-page illustrated bulletin, just issued by the British Aluminium Co., Ltd., of London, contains information on the practical application of this system. It is a reprint of an article entitled "A Modern System of Overhead Railway Track Construction," which describes the use of steel-cored aluminium cables on the Lake Erie and Northern Railway of Canada.

Unemployment.—The number of persons on October 22nd, 1923, recorded on the live registers of the Employment Exchanges in Great Britain was 1,249,500. This was 4,642 less than in the preceding week, and 236,378 less than the figure recorded on January 1st, 1923. The total included 940,900 men, 41,500 boys, 229,600 women, and 37,500 girls.

Czecho-Slovakia.—According to *Trua*, the late Prague Fair was a great success so far as sales were concerned. In numerous industrial departments, it says, sales totalling millions were effected, and these principally in the metal branches, and woodworking machinery has been sold in quantities for Rumania and Jugo-Slavia; autogen apparatus and bicycles were likewise in great demand. In the electro-technical branch much interest was taken, and especially for electric motors, of which one firm alone secured an order for 30 for Jugo-Slavia. Swiss and Belgian orders were secured for a new patent electric railway brake.

Official sanction has been granted to the embodying of the Brünner Elektrotechnische und Maschinenfabriks Company, with a capital of 3.5 million kronen. The scope of the company's operations are to be the electrical equipment of factories, workshops, and the like.

The Skodawerke has lately opened a factory at Doudlewetz for the production of electric motors, dynamos, transformers, &c., so that, instead of, as hitherto, supplying only steam turbines, it will be able to furnish complete turbo installations. It has lately secured the order for the supply to the Prague tramways of the electrical equipment for 10 locomotives.

Rawlplug Publicity.—The trade will be interested to know that, in order to further stimulate the demand for Rawlplugs, the Rawlplug Co., Ltd., of Cromwell Road, S.W.7, will have a full-page advertisement in the *Daily Mail* on November 2nd. A copy of the sheet is before us and its design is very effective.

For Sale.—Plymouth Corporation Electricity Department has for disposal two 100-kW, two 200-kW, and one 500-kW sets, engine driven. Mexborough Electricity Works has for sale two 100-kW, d.c. generators, coupled with Willans compound engine, one d.c. switchboard, one 250-cell, 400-amp.-hour Chloride battery. The County of Lanark District of the Middle Ward has for disposal surplus generating plant installed at the County Hospital, Motherwell. (See our advertisement pages to-day.)

New Italian Companies.—A company has been formed at Bergamo for the harnessing of the falls of Stobina and Ornica; its capital is 500,000 lire, and its style is the Società Anonima Elettrica Valtorta.

The Società Anonima Elettrocondutture is a company recently embodied at Milan for the manufacture of protective material for electric plants. It has a capital of 500,000 lire.

Canada.—Messrs. Canadian Vickers, Ltd., have purchased the plant and business of the Phœnix Bridge & Ironworks, Ltd. Mr. P. L. Miller, the general manager of Canadian Vickers, Ltd., commenting on the absorption of so large a company as the Phœnix Bridge & Iron Works, Ltd., says: "It is an indication of confidence on the part of British manufacturers in the future of Canada."—*Reuter* (Montreal).

New French Companies.—Andoux et Tresgots, société en nom collectif, has recently been formed at Paris (9, Rue Falguière) with a capital of 242,292 fr., to take over an electric lamp manufacturing business.

There has been formed at Levallois-Perret (Seine, 28, Rue des Arts), the Broadcasting Corporation, a company taking over the local manufacturing business of Guardioia, Lévy-Grunwald and Co. The capital is 250,000 fr. in 100-fr. shares.

Société Gaz et Electricité de la Souterraine is the style of a company formed for the purchase, construction and working of generating stations and distributing network, particularly in the department of the Creuse. The capital is 500,000 fr. in 100-fr. shares, paid up in cash.

Illumination.—Yesterday (Thursday) evening, at a Sales Conference held at the Bradford Corporation Electricity Offices, Mr. Ernest Stroud, chief technical engineer of Messrs. Holophane, Ltd., gave an address on "Illumination." The event was arranged by the E.D.A. Sub-Committee of the West Riding (Aire and Calder) Electricity District.

At a meeting of the Hackney and Stoke Newington Chamber of Commerce, at the Town Hall, Hackney, on Monday, November 12th, at 8 p.m., Mr. L. L. Robinson will give a short talk on "Maximum Demand System of Charging for Electricity in Connection with Shop Lighting." A lecture on and a demonstration of Modern Shop Lighting, by Mr. W. E. Bush, of the British Thomson Houston Co., Ltd., will follow.

Show-case Electrical Exhibits at Wembley.—With reference to our recent comments regarding the show-case accommodation that is available for electrical manufacturers who do not wish to carry the expense of personal attendance and incidentals in the Electrical and Allied Engineering Section of the British Empire Exhibition, we desire to draw the trade's attention to an illustrated circular which has been issued giving full information. It is issued by the British Electrical and Allied Manufacturers' Association, and we believe has been widely circulated throughout the industry, but firms who have not received it would do well to communicate with the secretary, at 36, Kingsway, London, W.C.2. Sketches appear, giving a very good idea of the style, size, and arrangement suggested of the show-cases, and prices are tabulated. For the benefit of any manufacturers who find the show-case scheme inadequate for the representation of their products, there are still some small or moderate-size sites available for stands.

Electrical Exhibition at Melbourne.—A *Reuter* dispatch states that the Electrical Federation of Victoria has decided to hold a four-weeks' electrical exhibition in Melbourne in September, 1924. It will be designed to cover all electrical uses, and wireless telegraphy and telephony in all their ramifications will be a feature.

The "Cosmos" Fire Competition.—The Metropolitan-Vickers Electrical Co., Ltd., asks us to state that entries for the "Cosmos" Fire Competition, for which the prize is a Wolseley 10-h.p. motor-car, will be received up to November 30th, instead of October 30th, as originally stated. Owing to the large demand for literature explaining the competition there has been some delay in distribution, which makes the time allowed for some competitors rather short, and the extension has been decided on in order to give everyone an equal chance.

A Swiss Investment Company.—The "Columbus" Company for Electrical Undertakings, of Baden, which is about to absorb the Swiss "Motor" Co., is interested chiefly in the Compania Italo-Argentina de Electricidad, of Buenos Ayres, which is reported to have further developed in 1922 and to have paid a dividend at the rate of 10 per cent., as compared with 9 per cent. in the previous year. Besides also controlling a coal supply company (the Compania General de Combustibles) the Columbus Co. has taken up an interest in the Lima Light, Power & Tramways Co., of Lima, Peru, and for the past year proposes to distribute a rate of 8 per cent. out of net profits of 3,220,000 fr., as against the same rate and profits of 2,750,000 fr. in 1921.

The Swedish Locomotive Tenders.—The Swedish State Railway Administration has published a list of the tenders recently received for the supply of 50 electric locomotives for the Gothenborg-Stockholm railway, to which reference has been made in previous issues of this journal. According to the list, four alternative offers at 179,000 kronen, 188,000 kr., 191,500 kr., and 199,500 kr. were received from the A.E.G.-Siemens group for the complete locomotive of the weight of about 79 tons. The Kochum-Westernhaus group asked 227,000 kr.; the Oerlikon Company tendered at 209,000 kr. on the basis of 67 kr. being equal to 100 Swiss francs, but the price would have been 237,500 kr. if only five locomotives had been ordered; and the Atlas-Diesel-Bergmann group quoted 199,400 kr. For the supply of solely the electrical equipment of the locomotives, the Siemens group asked 119,500 kr., or 110,000 kr. as an alternative; Brown, Boveri, 156,000 kr., exclusive of freight and duty; Atlas-Diesel-Bergmann, 118,000 kr. For the mechanical parts only, the A.E.G.-Siemens group tendered at 69,000 kr.; Kochum, 81,500 kr.; and the Atlas-Diesel, 81,500 kr. The price of the Swedish ring, which was accepted, amounted to 210,000 kr. per locomotive, exclusive of brakes.

Local Exhibitions.—Glasgow.—At the Health and Housing Exhibition that was held in the Kelvin Hall at Glasgow from October 1st to 20th, the Corporation electricity undertaking, of which Mr. R. B. Mitchell is the engineer and manager, had as usual a stand of exhibits, a photograph of which is reproduced below, fig. 1. On this occasion the hiring of apparatus

Fig. 1.—Glasgow Corporation Exhibition Stand.

was mainly dealt with, and the department was successful in booking 260 fires on hire besides over 50 cookers during the run of the exhibition—this being in addition to the ordinary business which was done simultaneously at the showroom.

Newport.—The electrical show at Newport (Mon.), which terminated on October 20th, was a great success, and the Elec-

Fig. 2.—Newport Electrical Exhibition—Cooking.

tricity Committee's optimism in taking the Stow Hill Pavilion, which has a floor area of 20,000 super feet, has been fully justified. During the week approximately 24,000 people visited the exhibition, and notwithstanding the fact that the Corporation issued complimentary tickets equivalent to the free admission of 21,000 people, over 8,000 paid for admission. Mr. A. Nichols Moore, borough electrical and tramway engineer, informs us that definite applications were signed for 227 additional cooking installations. Based on previous experience, he is satisfied that the additional load secured will represent a consumption of 350,000 kWh per annum. In addition to cooking apparatus, large orders for heating apparatus were secured, and considerable orders for washing and ironing apparatus, vacuum cleaners, electric machine tools, &c., were reported from all the stands. A pleasing incident was a private supper

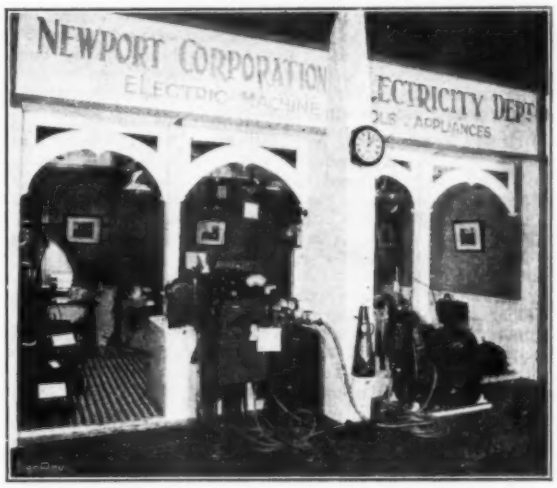


Fig. 3.—Newport Electrical Exhibition—Power.

party given by Alderman Fred Phillips, in his personal capacity, to the Corporation staff and the exhibitors at the close of the exhibition, at which Mr. Moore was presented with a handsome cigarette case and card case as a token of the exhibitors' appreciation at the manner in which he had organised and conducted the exhibition. The all-electric restaurant and buffet was a tremendous success, and highly appreciated by visitors to the exhibition.

A striking and attractive feature of the Newport Exhibition was the "all-electric" house arranged by Mr. Nichols Moore, in conjunction with a local furnishing company. The house consists of a dining room and kitchen, with an adjoining passage. It is well decorated and made to be dismantled and re-erected with ease. We understand from Mr. Nichols Moore that he will be glad to consider applications from other supply engineers with regard to the purchase or hire of this structure for exhibition work.

Cardiff.—Messrs. E. Bennis & Co., Ltd., will be exhibiting models of their conveying and coal- and ash-handling plant at the exhibition which is to be held at Cardiff by the South Wales Institute of Engineers from November 29th to December 8th. They will also show a working exhibit of the Bennis sprinkler stoker and compressed-air furnace as specially designed by them for burning South Wales coal.

Salesmanship Conferences.—The North-East Area Sub-Committee (hon. sec.: Mr. W. F. T. Pinkney) of the British Electrical Development Association has arranged for a series of Salesmanship Conferences during the coming session. They will be held in Messrs. Sopwith & Co's Lounge, 60, Northumberland Street, Newcastle-upon-Tyne, on the following dates:—November 22nd and December 20th, 1923; January 24th, February 21st, and March 20th, 1924.

The third E.D.A. Salesmanship Conference (London area) will be held on Friday, November 16th, at 7.30 p.m., at St. Bride's Institute, Bride Lane, E.C. (third floor). There will be a paper by Mr. A. F. Perry, on "How to Sell 'Heat,' and Problems Related to the Warming of Air and Body." Chairman: Major H. Richardson, M.C., F.R.S.E., M.I.E.E.

Production in Russia.—The new financial year in Russia begins with the month of October, and the output of the electrical manufacturing undertakings (the Central Electrical Trust, The Electrical Machine Trust, the Telephone and Telegraph Trust, and the Accumulator Trust) is expected to amount to 41,000,000 gold roubles in 1923-24. This compares with a production of an estimated value of 24,900,000 gold roubles in the year ended with September, 1923. In detail it is calculated that after the new equipment the lamp factories will be able to turn out from 10 to 12 millions of lamps in the current financial year, which quantity will almost satisfy the lighting season. Installation materials are to be produced to the extent of 800,000 pre-war roubles, or from 50 to 60 per cent. of the total requirements of the country. The production of transformers for from 10,000 to 115,000 volts is to be commenced this year, and if the necessary funds are forthcoming it is intended to start the construction of generators of 10,000 kW and of switchboard apparatus for up to 115,000 volts, while high-pressure insulators to the number of 40,000 are to be manufactured by the Insulator Works.

Imports into Russia.—The General Electrical Commission has entered into agreements with the Industrial Bank under which the latter has granted credits to the former to the extent of 413,000 gold roubles for making purchases abroad. In September the quantity of goods imported by the Commission amounted to 90 tons.

British Empire Exhibition Notes.—The Fulham Electricity Committee has recommended that £200 be contributed towards the expenses of the British Electrical Development Association's exhibit.

More than 300 firms in the engineering and shipbuilding industries of Great Britain will have exhibits in the British Engineers' Association Section in the Palace of Engineering. Plants used in iron and steel production and in mining will be present on a large scale, and a special feature is being organised which will be of interest to visitors from countries which are developing their own industries. The Association is erecting a fine Engineering Club.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are given in brackets.

Alembic. No. 436,943. Class 8. Electrometers, electric lighters and apparatus for use in telephony. Josef Millet, trading as J. Millet, 22, Farringdon Avenue, London, E.C.4. October 24th, 1923.

Simanco. No. 438,555. Class 6. Electric motors and parts, electric fans and parts, &c. The Singer Manufacturing Co., 149, Broadway, New York, U.S.A. (Cruickshank & Fairweather, 29, St. Vincent Street, Glasgow.) October 24th, 1923.

Re-Echo (lettering and design). No. 437,034. Class 8. Wireless telephony receiving sets. The Re-Echo Electrical Manufacturing Co., Ltd., 43, Johnson Street, Westminster, S.W. October 24th, 1923.

Variadon. No. 439,434. All goods in Class 8. The Dubilier Condenser Co. (1920), Ltd., Ducon Works, Goldhawk Road, Shepherds Bush, London, W. October 24th, 1923.

"Towncrier," Lend Me Your Ear (lettering and design). No. 439,844. Class 8. Wireless telephony and telegraphy apparatus, instruments and contrivances. Walter Harvey, trading as the Harvey Radio Co., 10-12, Pentonville Road, London, N.1. October 24th, 1923.

Salesmanship.—On Monday next at 8 p.m., at the Engineers' Club, Mr. A. H. Williams (Selfridge & Co., Ltd.) will read a paper on "Salesmanship," at a meeting of the Institution of Rubber Industry.

Catalogues Wanted.—The managing director of the Co-Operative Cinema Booking & Publicity Co., Ltd., 12, Tavistock Street, Strand, W.C.2, asks for full information from manufacturers of advertisement mediums in which electricity plays a part.

LIGHTING AND POWER NOTES.

Aberdeen.—Year's Working.—The accounts of the city electricity supply undertaking (engineer and manager: Mr. J. A. Bell) for the year ended July 31st last record a total income of £179,391, comparing with £171,736 in the previous year. Working expenses absorbed £80,646 (£85,857), leaving a gross profit of £98,745, as against £85,879. After meeting capital charges, &c., the net profit for the year was £20,960, as compared with £5,646 in the preceding year. Capital expenditure during the year amounted to £40,602. The amount of energy sold increased from 18,688,033 to 22,146,517 kWh.

Abergele.—Electricity Scheme.—The Town Council has received a report from its consulting engineer regarding the proposed electricity supply for the district, and is applying to the Electricity Commissioners for an Order authorising it to carry out the scheme.

Andover.—Electricity Scheme.—The Town Council has decided to consent to the application of the Western Electric Distributing Corporation for a Special Order to supply electricity in the borough.

Banchory.—Proposed Electricity Scheme.—The Town Council has under consideration a proposal for providing an electricity supply for the town, and has received a report on the scheme from its consulting engineer. The estimated cost of carrying out the scheme is £8,300, and the charge to consumers will be 10d. per kWh. Application is to be made for a Provisional Order authorising the Council to carry out the work.

Barrow.—Loans.—The Corporation is to extend its electricity supply to mines and quarries in Furness, and application is to be made to the Electricity Commissioners for sanction to the borrowing of £13,356 for mains and £15,050 for extensions to plant to meet the increased demand.

Brighton.—Extension of Supply.—The Town Council is to extend its electricity supply system to Southwick. The initial cost of carrying out the scheme will be £14,450, and the charges for electricity will be 7d. per kWh for lighting, and 2d. per kWh for power.

Loans.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £10,000 for mains and £15,000 for services.

Callington (Cornwall).—Electricity Scheme.—Application has been made to the Electricity Commissioners by Mr. W. J. Glover for a Special Order authorising him to supply electricity in the urban district of Callington and the rural district of Launceston.

Chester.—Extension of Supply.—The Town Council is to extend its electricity supply system to Eccleston at a cost of £5,500.

Chesterfield.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £5,125 for mains, services, &c.

Continental.—Italy.—The construction of the Fiumerotto tunnel has recently been completed, and the flow of the River Ariene diverted to Tivoli, where a hydro-electric power station has been erected. The power to be obtained from this source is estimated at 30,000 h.p., and the energy will be distributed to the cities of Tivoli and Rome.

Cuckfield.—O. H. Lines.—The Ministry of Transport held an inquiry on October 23rd relative to the question of erecting overhead electric wires in Cuckfield and Lindfield by the Hayward's Heath and District Electricity Supply Co. Objections were based on the ground that overhead wires would spoil the beauty of the district, and it was understood that a compromise was likely, and that underground mains would be laid in a portion of the area.

Exeter.—Extension.—The Town Council has lodged an objection to the application of the Topsham Electricity Supply Co. for a Special Order authorising it to supply electricity in the parish of Topsham, and the Electricity Committee has recommended that application be made to the Electricity Commissioners for a Special Order authorising the Council to supply electricity within the parishes of Topsham, Pinhoe, Alphington, and Idle, and that the maximum charge be fixed at 10d. per kWh. It is also proposed to apply for sanction to the borrowing of £15,000 to carry out the scheme.

Halifax.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. W. M. Rogerson, M.I.E.E.) for the year ended March 31st last record a total income of £161,704, as compared with £169,383 in the previous year. Working expenses amounted to £85,646 (£105,393), leaving a gross profit of £76,058 (£63,990). After meeting capital charges, &c., there was a net profit for the year of £27,069, an increase of £6,608 on the previous year's profit. Against this, however, must be placed the following items:—Deficiency brought forward, £37,674; new plant, &c., £14,833; renewal of mains, £2,114; contribution in aid of rates, £8,670. A deficiency is therefore carried forward amounting to £36,222. The capital expenditure during the year amounted to £103,258, the largest single item being £44,600 for a 10,000-kW turbo-alternator. The amount of energy sold increased from 15,797,312 to 19,849,432 kWh, and the average price obtained per kWh was .327d., an increase of .017d.

Hinderwell.—Electricity Scheme.—The Urban District Council has decided to communicate with the Cleveland and South Durham Electric Supply Co. with respect to the provision of a supply of electricity for the Council's area.

Irish Free State.—Navan.—The new hydro-electric power station was formally opened on October 23rd by the chairman of the Urban District Council. The plant consists of three 40-h.p. turbines, one single and two coupled to one generator. Supplemental power will be available, when required, from a 110-b.h.p. crude oil engine. The power house was designed by the Council's engineer, Mr. R. S. Barnes. The turbines were supplied by Messrs. Hay, Maryan & Co., Ltd., the oil engine by Messrs. W. H. Allen & Sons, Ltd., and the dynamos and switchboard were installed by Messrs. Drake and Gorham, Ltd. The overhead work was carried out by the Irish Electrical Co., Dublin. The cost of the scheme was £12,000.

Maryborough (Queen's Co.).—The Town Commissioners are applying jointly with the Mountmellick local authorities for an Order authorising them to supply electricity in the district.

Kingston-on-Thames.—Change-over.—The Electricity Commissioners have consented to the alteration of the system of electricity supply from 105 V to 415 V for power and 240 V for lighting in the remaining portion of the borough in which the 3-phase system is not at present in operation.

Liverpool—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £100,000 for mains.

Luton.—Pre-war Prices.—On Tuesday last week the Corporation decided to lower the tariff for electrical energy to pre-war prices, as from the end of the September quarter. The following charges now obtain: Power 2d. per kWh for the first 500 per quarter, 1½d. for the next 1,500, 1d. for the next 3,000, and 0.75d. for all in excess. Lighting, 6d. per kWh for the first 70 hours of average maximum demand per quarter, 1½d. for the next 1,500, 1d. for the next 3,000, and 0.75d. for all in excess; or 3½d. per kWh, flat rate. Heating and cooking, 0.5d. per kWh. A combined lighting and heating tariff is also offered, namely, 6d. per kWh for the first 70 hours m.d. per quarter, 1½d. for the next 100 hours of the same m.d. in winter quarters, 300 hours), and 0.5d. for all energy in excess. A special tariff is framed on the basis of load factor: L.f. 20 per cent. or more, 0.900d. per kWh; 25 per cent., 0.830d.; 30 per cent., 0.720d., and so on, down to 0.350d. at 80 per cent. load factor. A coal clause is included.

Year's Working.—For the year ended March 31st, 1923, the energy sold was 12,197,486 kWh, over 11 million to private consumers; the maximum load was 6,300 kW. The gross income was £76,840, working expenses £43,139, and gross profit £33,701. After paying the loan charges there remained a net profit of £11,215. The capital expenditure was £310,072. Motors connected were rated at 11,932 h.p., and the heating load connected was 4,126 kW. The undertaking was begun in 1902, and after three years a profit was made in every year except 1919, the net profit being in 1920, £15,391; in 1921, £8,110, and in 1922, £9,813. On March 31st the sinking fund stood at £30,937, the reserve and renewals fund at £8,356, and the appropriation account had a credit balance of £31,094. The loans outstanding amount to £186,429. Out of revenue £31,285 has been spent on capital account. The average price obtained per kWh sold was in 1914 1.06d., in 1922 2.45d., and in 1923 1.51d. Mr. W. H. Cooke, A.M.I.E.E., is the electrical engineer.

Mid-Lancashire Electricity District.—Order of Constitution.—With reference to the local inquiry held by the Electricity Commissioners at Preston on July 31st last with respect to the draft order embodying the scheme approved by them for the reorganisation of the supply of electricity in the above-named district, the Commissioners have now issued an Order giving effect to the approved scheme, and the Order has been submitted to the Minister of Transport for confirmation.

North Wales and South Cheshire Joint Electricity Authority.—Transfer of Powers.—The important step of the formal transfer to the North Wales Power Co. of the powers conferred by the Electricity Commissioners upon the North Wales and South Cheshire Joint Electricity Authority with respect to the production and supply of electricity was completed on October 26th at the meeting of the Joint Authority, which took place at Llandudno, Mr. A. Hewitt, chairman of the Llandudno Council, in the chair. The Authority had met a fortnight earlier, and had appointed a special committee to consider and settle the draft deed of transfer. This committee now reported that it met in London on October 22nd and discussed the draft, as amended by it, with the Power Company's solicitors, representatives of the Electricity Commissioners being present. Ultimately, the draft deed, as amended and agreed to by all the parties present, was approved of by the special committee and the Electricity Commissioners, and the Joint Authority fixed its common seal to it.

The General Purposes Committee reported that it met in London and appointed Col. F. A. Cortez Leigh chairman. Mr. A. Conoily, clerk to the Llandudno Council, was appointed acting clerk for a period of 12 months, his remuneration to be considered at the end of that period, and he was asked to prepare draft standing orders for the conduct of the business of the Joint Authority and the committees.

The General Purposes Committee was authorised to consider applications under the provisions of Section 26 of the Electricity Supply Act, 1919, for Special Orders. The principal offices of the Joint Authority are at the Town Hall, Llandudno.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Luton.—The charge of 25 per cent. above pre-war rate has been abolished. (See under "Luton.")

Darlington.—Lighting: From 3½d. to 2d. per kWh for all energy consumed during the summer months, and for an equal number of kWh used during the winter months. Heating: A reduction of ¼d. per kWh on the same basis. Power: Reduced by ¼d. per kWh. Tramways: A reduction of ¼d. per kWh for all energy used.

Ealing.—Lighting: From 7d. to 6d. per kWh. Power, heating, and cooking: From 2½d. to 2d. per kWh. Street lighting: A reduction of 25 per cent.

Hertford.—*The North Metropolitan Electric Power Supply Co.*—Lighting: From 9d. to 8d. per kWh. Heating: From 3d. to 2½d. per kWh. Power: The surcharge of 50 per cent. is reduced to 33⅓ per cent.

Birmingham.—Low-pressure supplies: A reduction of from ¼d. to ½d. per kWh, according to the class of supply.

Hammersmith.—A reduction from 6d. to 5d. per kWh.

Southmolton.—Electricity Scheme.—Colonel P. T. Ekin recently held an inquiry into the application of the Town Council for an Order authorising it to supply electricity. A petition signed by 385 persons objecting to the scheme was submitted, while there was also objection to the suggested site near the gas works. The Town Clerk said the estimated cost of the scheme, exclusive of land and legal expenses, was £4,000, and as a result of a circular 51 persons agreed to take 545 lights and 32 h.p. in motors. The Council was strongly advised not to grant a monopoly. The Mayor expressed the view that, instead of laying out £2,000 on the gas works, it would be better to put the money into an electric light scheme.

South Shields.—Electricity Extensions.—The Corporation has decided to construct a new engine room at the electricity works at a cost of £35,000, and application is to be made to the Electricity Commissioners for sanction to the borrowing of the amount required.

Special Orders.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation Special Orders made by them authorising the Urban District Council of Maesteg to supply electricity in the district, the Western Electric Distributing Corporation, Ltd., to supply electricity in certain portions of the urban district of Wantage and certain parishes in the rural district of Wantage, and the Rushden and District Electric Supply Co., Ltd., to supply electricity in the urban district of Raunds and certain parishes in the rural districts of Thrapston, Wellingborough, and Bedford.

St. Helens.—Year's Working.—The accounts of the borough electricity undertaking (electrical engineer: Mr. F. N. Rendell Baker) for the year ended March 31st last record a total income of £77,729, as compared with £87,629 in 1921-22. Working expenses were £46,002 (£62,579), leaving a gross profit of £31,727, as against £25,050. After payment of capital charges, &c., the sum of £5,481 was carried forward, as compared with £4,888. During the year the sum of £26,942 was spent on capital account, this included £10,444 for machinery and £9,382 for mains and services. A total of 19,135,833 kWh of energy was sold, an increase of 5,187,606 kWh on the previous year's figure.

Stalybridge.—Proposed New Power Station.—An application is being made to the South-East Lancashire Advisory Board, the Electricity Commissioners, and the Ministry of Health by the Joint Tramways and Electricity Board of Stalybridge and Ashton for sanction to erect a generating station at Stalybridge.

Torquay.—Extension of Area.—The Town Council has applied to the Electricity Commissioners for a Special Order authorising it to extend its area of electricity supply so as to include the parish of Cockington, in the rural district of Newton Abbot.

United States.—Delaware River Scheme.—The Philadelphia Electric Co. has recently purchased a site on the Delaware River for the construction of a large power station. The station will have an ultimate capacity of 600,000 kW built in three units of 200,000 kW, each of them comprising four 50,000-kW generating sets. It is expected that work on the new station will be commenced early in 1924.—*Electrical World.*

Wareham.—Inauguration of Electricity Supply.—The formal opening ceremony of the undertaking of the Wareham Electricity Supply Co., Ltd., took place on October 23rd, the Mayor switching on the light from the power station. The undertaking was originally started by the townspeople, but was subsequently transferred to the company.

Wirral.—Electricity Order.—The Gayton Park Electricity Co., Ltd., has applied to the Electricity Commissioners for an Order authorising it to supply electricity in the urban districts of Bebington and Bromborough, the urban districts of Neston and Parkgate and certain parishes in the rural district of Wirral.

TRAMWAY AND RAILWAY NOTES.

Australia.—Standard Tramway Rails.—Following an inter-State conference of tramway engineers in Melbourne, a suitable design for a standard rail was agreed upon. The object of the conference was to procure a rail which could be rolled in Australia; at present they are imported from England and America. It is suggested that the different tramway authorities should pool their requirements, so that the rails can be manufactured in quantities in Australia. They could be rolled either at Newcastle or Lithgow.—*Reuter's Trade Service* (Melbourne).

Birkenhead.—Unemployment Relief Scheme.—The Town Council has decided to renew certain portions of the tramway track at an estimated cost of £50,534, with a view to providing work for the unemployed, and application is to be made to the Unemployment Grants Committee for a grant towards the scheme.

Continental.—POLAND.—*Reuter's* Agency learns from an authoritative Polish source that the scheme for the construction of a net of electric railways in the coal area of Cracow and Dabrowa formulated about two years ago by the Coal Mining Association is now in process of realisation. The Polish Electric Railway Co. has just been floated with a capital of three million gold marks. The railways will connect the Nabrowa basin with that of Upper Silesia, and it is ultimately intended to extend them as far as Cracow.

Liverpool.—LIGHT RAILWAYS ORDER.—The Minister of Transport has recently made the Liverpool Corporation Light Railways Order, 1923, authorising the construction of light railways in the city.

London.—TUBE EXTENSIONS.—Plans are now practically completed for the further development of the Tube system in South-West London. The new scheme provides for an expenditure of another £6,000,000, and employment will be found for between 25,000 and 30,000 men for a period of nearly two years, including present work now in hand. The new scheme of construction provides for:—(1) The immediate extension of the Tube railway from Clapham Common to North Morden, a distance of over five miles, 4¼ miles of which will be tunnel work. (2) The construction of seven new stations at Nightingale Lane, Balham, Trinity Road, Tooting Broadway, Colner's Wood, South Wimbledon, and North Morden. (3) The reconstruction of Piccadilly Circus and Leicester Square stations. (4) The rebuilding and further development of Waterloo Tube station as an interchange point. In connection with the tunnelling work, electric rotary excavators for driving the twin tunnels forward are to be introduced. The new type of excavator enables 20-25 ft. of tunnelling to be accomplished daily. All the new stations, except North Morden, which is to be a surface station, will be modelled on lines whereby the passenger will step on to an escalator in the booking hall and be carried direct to the platform, thus avoiding anything in the nature of subways. It is estimated that the journey from street to platform, including booking, will occupy little more than 60 seconds. The new section of the line will serve a population of 300,000, and provision is being made for carrying over the new extension 50,000,000 passengers annually. Schedules are being prepared which will provide for a 2-minute service of trains. Tooting will be brought within 25 minutes of the Bank and Piccadilly Circus, whilst South Wimbledon will be within 33 minutes of Moorgate. At North Morden car sheds and repair shops are to be erected to provide for 250 cars. Waterloo station is to be reconstructed, and escalators, passimeters, &c., are to be installed. The rebuilding of Piccadilly Circus station provides for the installation of six escalators and a large circular station immediately below the Circus. When finished, it is claimed that it will be the best underground station in the world, with a capacity for handling nearly 100 million passengers annually. Regarding Leicester Square, new work proposed is the reconstruction of the present booking hall and additional lifts. This work will take under a year. The new programme is to be pushed forward immediately, and it is hoped that the new Tube line to S.W. London will be opened for traffic by the middle of 1925, or 18 months after the commencement of work. If this is accomplished it will be a record in Tube railway construction.

Preston.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager: Mr. H. Clayton, A.M.I.E.E.) for the year ended March 31st last record a total income of £94,400, comparing with £99,318 in 1921-22. Working expenses amounted to £70,165 (£75,853), leaving a gross profit of £24,235, as against £23,465. Capital charges, &c., absorbed £17,373, and £3,000 was transferred to reserve fund, leaving a net profit of £3,861, as compared with a profit of £4,567 in the previous year. To this sum is added a profit of £788 on the motor omnibuses. The car mileage increased from 1,190,220 to 1,212,936, but the number of passengers carried was reduced from 13,261,659 to 13,234,674.

TELEGRAPH & TELEPHONE NOTES.

Chile.—INTERNATIONAL RADIO SCHEME.—Representatives of French and American interests, in combination with Chilean financiers, have formed a company for the installation of a powerful radio station to communicate with Europe. The permission of the Government to carry out the scheme has been obtained.—*Reuter* (Santiago-de-Chile).

China.—RADIO STATIONS.—It is reported that the Chinese Cabinet on October 23rd formally sanctioned the Federal Wireless Co.'s contract, and that the United States Legation has been informed of the fact. The construction of the first station at Shanghai will probably be begun this winter. The Japanese Legation has again protested against the scheme on the ground that it violates the Mitsui contract of 1918.—*Morning Post.*

Irish Free State.—IMPROVED CABLE SERVICE.—An improved cable service between the Irish Free State and America has been secured by the Irish Postmaster-General. A direct wire now connects Dublin and Cork with the cable station at Valentia, Kerry. Week-end cable letters may be handed in on Saturday night for delivery in New York by Monday morning.

Italy.—TELEPHONE SERVICE.—The Commercial Secretary at Rome has forwarded to the Department of Overseas Trade a copy of the technical programme prepared by the Minister of Posts and Telegraphs relative to the transfer of the Italian telephone system to private enterprise. This document can be inspected by British firms at the Department of Overseas Trade. (Ref. 18,817/F.W./C.P.)

TELEGRAPHY.—A decree has been published notifying that reserving to the State the right to set up and work telegraph lines for public or private use, the Government has liberty to grant to public bodies, companies, or individuals concessions (1) to work State lines, (2) to work multiple-system sectors of Government circuits, (3) to construct and work new telegraph lines for private or public use, and (4) to cede the ownership of circuits and State undertakings. The concessions are subject to numerous restrictions as to the kind of any new plant or extensions set up, methods of working, tariffs, &c.

INTERFERENCE COMMITTEE.—Giving effect to a resolution passed at the 27th conference of the Associazione Elettrotecnica Italiana last year, a committee has been nominated to "study and formulate norms to render possible the coexistence of telegraph and telephone plant and other electric installations," to the end of ascertaining and obviating disturbances produced in telegraph circuits. The committee, which includes five representatives of the State administration, has already started its labours.

Radio Stations in the Arctic.—The trading posts which the Hudson Bay Co. maintains for communication with the Eskimos, well within the Arctic Circle, are to be a little less lonely than they have been. The two steamers which are taking stores north and will collect fur, are taking out a radio set for each of the principal stations. Hitherto all communication with the outside world has been closed for six months of the year.

Radio-Telegraphy.—PROVINCIAL SERVICE.—The first provincial radio-telegraph office was opened at Liverpool on October 29th by the Marconi Co. An underground cable provides direct communication with the South, and is automatically linked with the transmitting station. There is a possibility of a similar service being established at Manchester in the near future.—*Daily Dispatch.*

The Far East.—CABLE COMMUNICATION.—The restoration of direct service on the lines of the Indo-European Telegraph Co. to Crimea, Iraq, India, and the Far East was accomplished last month, so that just nine years after the outbreak of the world war the three main telegraph routes between Great Britain and the Far East are again in daily operation. They are the Great Northern, *via* Russia and Siberia; the Indo-European, *via* Russia, Persia, and India; and the Eastern and Eastern Extension, through the Mediterranean, the Red Sea, and the Indian Ocean. The American Continent is served by the Commercial Pacific cable from San Francisco, *via* Hawaii and the Philippines to Japan.—*Financial Times.*

RADIO NOTES.

Australia.—RADIO TELEGRAPH REGULATIONS.—Regulations made by the Governor-General of the Commonwealth of Australia under the Australian Wireless Telegraphy Act, 1905-1919, came into force on August 1st, 1923. They deal with the issue of licences for radio telegraph or telephone transmitting and receiving stations, broadcasting, sale of broadcasting apparatus, working of stations, &c. A copy of Statutory Rules, 1923, No. 97, embodying the regulations, may be seen by United Kingdom firms at the Department of Overseas Trade (Ref. 12,425/ED/CP).

France.—BROADCASTING.—A syndicate of dealers in, and manufacturers of, radio apparatus at Marseilles has been formed to organise regular broadcasting.

Germany.—RADIO-BROADCASTING APPARATUS.—In expectation of the release from Post Office control of radio apparatus in Germany, the Telefunken, the Lorenz, and the E. R. Huth companies have formed a broadcasting company for the exclusive sale of the apparatus made by these three firms, which is to be placed on the market uniformly and as cheaply as possible.

London.—NEW RADIO-BROADCASTING STATION.—Plans for the acquisition of a building in Wardour Street, W., for a new transmitting station for the British Broadcasting Co. have fallen through, but it is hoped to secure premises before long so that two London programmes can be given. It is hoped to retain the present station at Savoy Hill, Strand. From one station it may be possible, if the authorities agree, to transmit Parliamentary debates, educational matters, or lectures.—*Daily Mail.*

Monte Carlo.—BROADCASTING.—It is reported that the Western Electric Co. is erecting a radio broadcasting station at Monte Carlo.

Sweden.—NEW STATIONS.—The Swedish Broadcasting Co. is erecting six transmitting stations, the power of which will range from 500 to 1,500 watts; they will operate on wavelengths between 350 and 625 metres, and it is expected that they will be easily audible in this country.—*Daily Mail.*

ELECTRICITY SUPPLY AT HALIFAX.

Inauguration of New Plant.

A public supply of electricity first became available in the County Borough of Halifax 30 years ago. It may be noted that Halifax claims to have been the first public electricity supply authority in Yorkshire to use steam turbines—two 200-kW Parsons d.c. sets having been installed in 1898—and also to have adopted 3-phase a.c. in Yorkshire in 1902.

Apart from its utility as a public service, the electricity undertaking has resulted in a financial gain in aid of the rates, amounting (during the last 20 years) to upwards of £87,000. In April, 1920, it was decided to install an additional turbo-alternator. As the switchgear in use at that time was designed only for hand operation and to control small plant, it became necessary to modify it and also to install new gear suitable for remote control. This involved the erection

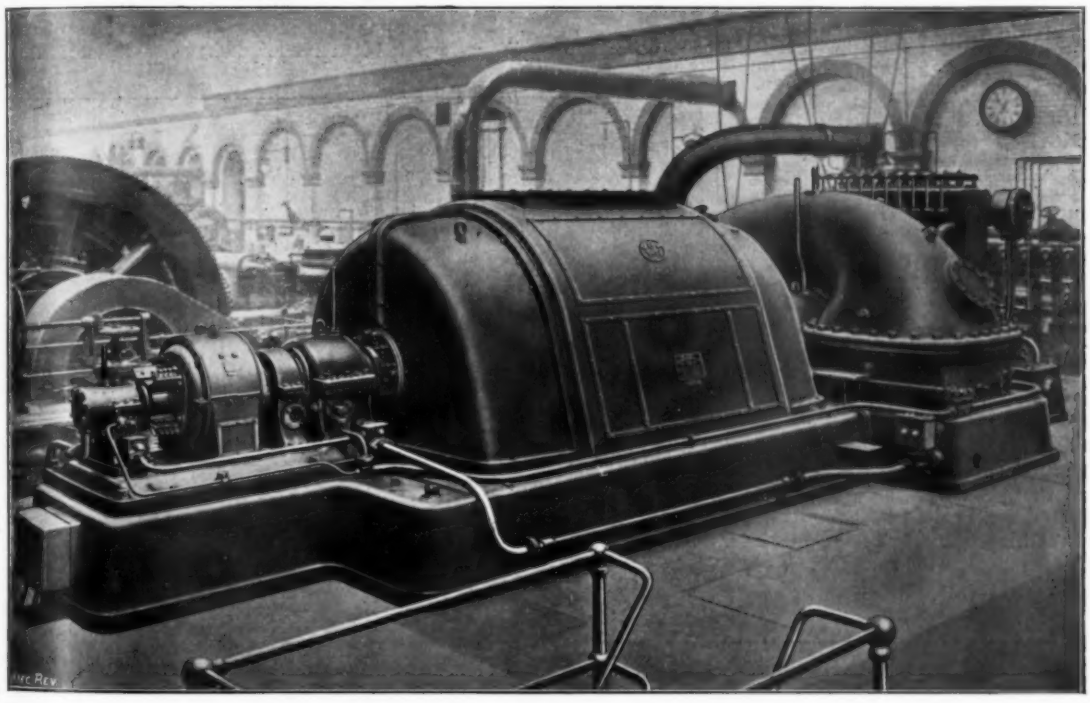


Fig. 1.—A B.T.-H. 10,000-kW, 3,000-r.p.m. Turbo Alternator.

of a new switch house for the e.h.p. motor-operated switchgear and the installation of a suitable bench board for its remote control. The new set has displaced a d.c. 750-kW dynamo driven by a low-speed cross-compound horizontal engine. It was constructed by the British Thomson-Houston Co., Ltd., and is rated at 10,000 kW at a speed of 3,000 r.p.m. It generates three-phase current at 6,600 volts, 50 cycles, and has an overload capacity of 25 per cent., so that its maximum continuous output is 15,625 kVA at 80 per cent. power factor, using steam at a gauge pressure of 160 lb. per sq. in., superheated 180 deg. F. (total temperature 550 deg. F.), and exhausting into a 28-in. vacuum.

The condensing plant was built by Messrs. Worthington-Simpson, Ltd., to specifications issued by the electrical engineer and manager of the undertaking, Mr. W. M. Rogerson. The turbine under full-load conditions exhausts at the rate of 125,000 lb. of steam per hour; the condenser is of the surface type and is provided with solid-drawn tubes $\frac{3}{4}$ in. in external diameter made of 70 per cent. copper, 29 per cent. zinc, and 1 per cent. tin. There are in all 7,300 tubes, representing 23,000 sq. ft. of cooling surface.

The circulating pump is of the centrifugal type, motor driven, and delivers at the rate of 17,500 gallons per minute, forcing the water to the head of the cooling towers. The motor is of 300 b.h.p., and the pump is provided with 30-in. discharge piping. The hydraulic vacuum pump for extracting the air from the condenser is of Messrs. Worthington-Simpson's design; it is a combination of a centrifugal pump with hydraulic ejector.

In addition, an "Ejectair" steam air pump made by Messrs. Hick, Hargreaves & Co. is installed as a stand-by for the hydraulic vacuum pump.

Four cross-type marine boilers, together with superheaters, are being supplied by Messrs. Babcock and Wilcox, they being arranged in pairs with a separate economiser by Messrs. E. Green & Son for each boiler, the economisers being fixed above the boilers. The evaporative capacity of each boiler is 37,000 lb. of steam per hour, and they can be used either with induced, forced, or balanced draught. Two of the boilers are already working, while the other pair is in course of erection.

Two further cooling towers have been erected, making a total of six towers now in use. The water inlet is 24 ft. above the ground level, each tower being capable of cooling 220,000 gallons of water per hour from 105 down to 80 deg. F., with an air temperature of 60 deg. F. and with a humidity of 80 per cent. The total height of the towers is 70 ft. above ground level. The towers were supplied by the Premier Cooler and Engineering Co., Ltd.

A new suite of showrooms, together with a sales bureau, is rapidly nearing completion in Town Hall Street, East. The sales bureau will be on the ground floor with an imposing central entrance, from which an easy staircase leads to the first floor where the showrooms and demonstration rooms are located. These will

include a lounge, dining-room, bedroom, bathroom, kitchen, &c., all fully equipped with modern appliances for electric lighting, heating, cooking, ventilating, and washing; they are tastefully decorated and furnished, and made to look as homely as possible.

The Corporation has decided to put into operation a simple hire scheme for electric cookers complete with kettle, wiring and fixing, the rental being 7s. 6d. and 8s. 6d. per quarter. A hire-purchase scheme is also in operation, with payments spread over three years.

The new plant was officially inaugurated on October 18th, Alderman T. Hey, J.P. (chairman of the Electricity Committee), and Mrs. Hey formally starting the plant. As Mrs. Hey released the ribbon, which started the machine, Mr. A. Lucas (of the British Thomson-Houston Co., Ltd.) presented her with a gold wristlet watch. The company subsequently made a tour of the station, following which the visitors were entertained to tea.

Mr. A. Lucas pointed out that the consumption of electricity in Halifax was still a little smaller than in some neighbouring towns; for instance, in Halifax it was 97.4 kWh per head of population, as against Bradford's 139 per head.

Mr. W. M. Rogerson, who has now been 21 years in the service of the Corporation, explained that the output of the undertaking was now 20,000,000 kWh per annum and, in addition to the generating station, there were from 70 to 80 sub-stations to look after.

ELECTRIC WINDERS FOR THORESBY COLLIERY.

A B.T.-H. Installation.

An order for two electric winders has been placed with the British Thomson-Houston Co., Ltd., by the Bolsover Colliery Co. for the Thoresby Colliery.

The winders, which will be used for sinking shafts to a depth of 350 fathoms, are each designed for a normal coal load of 3 tons 18 cwt. per wind, or a total output of 195 tons per hour, for each winder. Parallel drums, 18 ft. in diameter and 10 ft. 6 in. wide, will be used in conjunction with a balance rope, and the motors, which will be coupled direct to the drums, will each have a continuous rating of 1,500 h.p.

Two motor generator sets, each equipped with a 20-ton flywheel, will be used to convert the energy of the supply from 3-phase alternating current at 2,200 volts to direct current at 650 volts and, by means of an automatic contactor-type slip regulator, the peak loads during the acceleration periods will be drawn from the kinetic energy of the flywheels. The adoption of this method will result in a practically uniform demand on the supply mains.

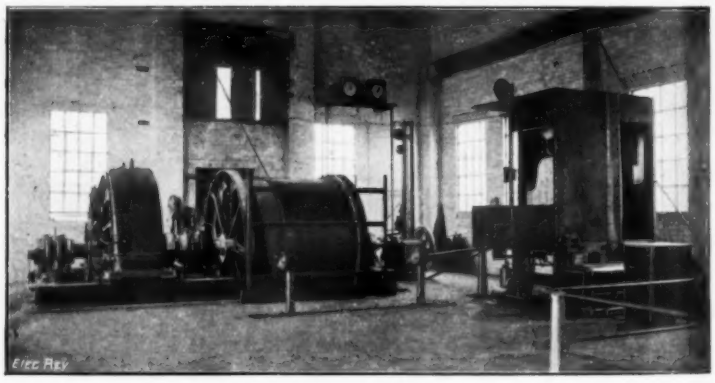


Fig. 2.—Electric Winder at Staveley Co.'s Pit.

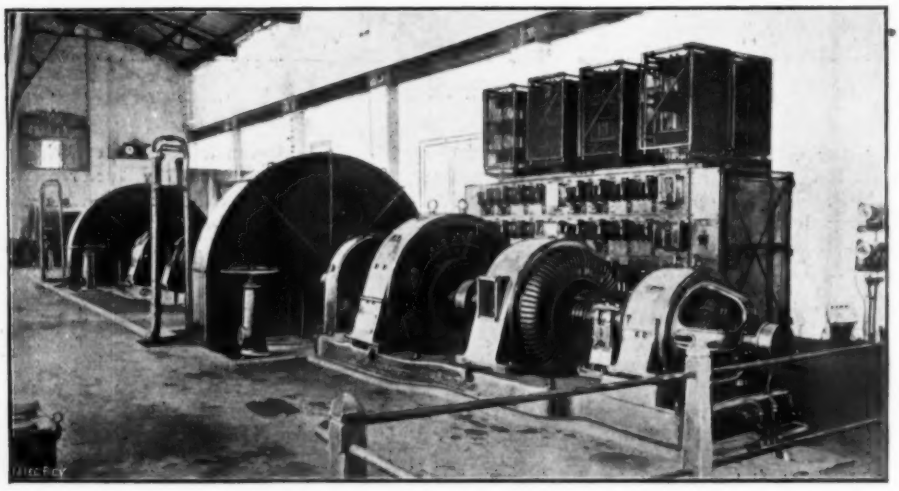


Fig. 1.—Ward-Leonard Ilgner Equipment.

The control gear, which is to be of the most up-to-date design, will incorporate a very complete system of safety and emergency devices and, in addition to the usual high- and low-pressure switchgear, change-over gear will be incorporated to enable each motor to be supplied from either motor-generator set.

The accompanying illustrations are views of similar Ward-Leonard Ilgner equipment to that described above which was recently completed by the British Thomson-Houston Co. at one of the Staveley Coal & Iron Co.'s pits.

The Thoresby Colliery will be situated in the middle of the Dukeries District of Derbyshire, where it is a condition of the lease of the mineral rights that no smoke or steam shall be emitted from the surface workings of the pits and, consequently, this colliery is being planned on an "all electric" system, power being taken by overhead lines from power houses situated at other collieries outside the district.

The mechanical parts of these winders will be constructed by Messrs. Robey & Co., Ltd., of Lincoln. Electric winding had a hard fight for adoption in its early stages, but is now standard practice. Will the next step be the use of stainless steel hoisting ropes? It is purely a question of cost.

THE ELECTRICAL EQUIPMENT OF THE TIVOLI KINEMA, STRAND, LONDON.

An important electrical installation has been carried out at the Tivoli, a new building on the site of the old Tivoli Music Hall. Conjointly designed by Mr. Bertie Crewe and Messrs. Gunton & Gunton, architects, as a kinema theatre, the building has a seating capacity of 2,200; the building contractors were Messrs. F. G. Minter, of Putney.

The total amount of electrical power required for all services is 200 kW; supplies are obtained from the Charing Cross, West End and City Electricity Supply Co., Ltd., and the Metropolitan Electric Supply Co., Ltd., whose services are run into separate chambers in the building, and separated by a fireproof partition. The control gear, which is all ironclad, together with the Supply Co.s' meters, is mounted on a substantial iron frame in each chamber and earthed by means of $\frac{3}{4}$ in. × $\frac{1}{8}$ in. copper strip to the water mains.

All cables above 0.075 sq. in. section are paper-insulated, lead-covered, and steel-armoured, supplied by the Western Electric Co., Ltd.; below this size Henley's v.i.r. cables are used.

In order to comply with the L.C.C. requirements and to eliminate any other illuminant in the building other than electricity, it has been necessary to connect all fittings constituting the "police lighting" to both the supply authorities' cables. Thus, the exit box signs and other fittings, as required, are wired to be continually supplied by two separate and distinct circuits respectively fed from the two companies' mains.

In other instances, in all parts of the building open to the public, the lights are divided between the two supply companies. The v.i.r. wiring is run in heavy screwed barrel, which is electrically and mechanically continuous throughout. The distribution boards are let flush into the walls and covered with a neat mahogany panel which acts as a door.

The main control for the auditorium lighting is in the operating room, and in the pay boxes for the stairs, corridors, entrances, and other portions of the house. The latter lights are also locally controlled by key switches.

The auditorium is lighted entirely by concealed lamps or lamps let into the ceilings or walls, the feature being the lighting of the five domes by means of special concealed reflectors. Three colour effects, namely, red, blue, and amber, and various combinations of these colours are obtained, the intensity of the light being regulated by Igranic patent metallic dimmers controlled from the operating box. The operating gear is designed to give practically any combination of dimming required. Clapper switches are connected to short-circuit the dimmers in case of emergency and

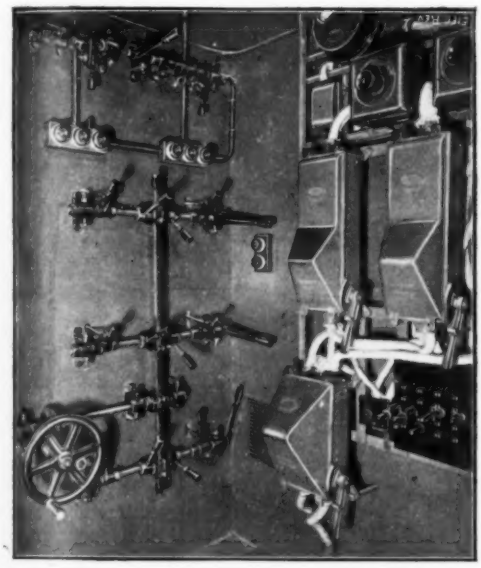


Fig. 1.—Control Gear for Auditorium.

Fig. 2.—Dimmers and Switchboard for Auditorium.

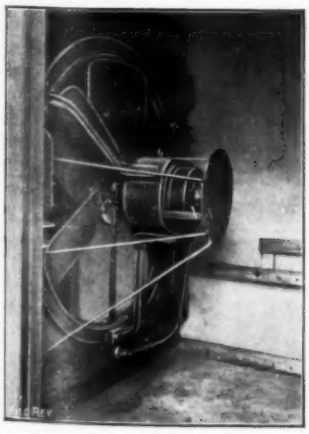


Fig. 3.—Exhaust Fan.

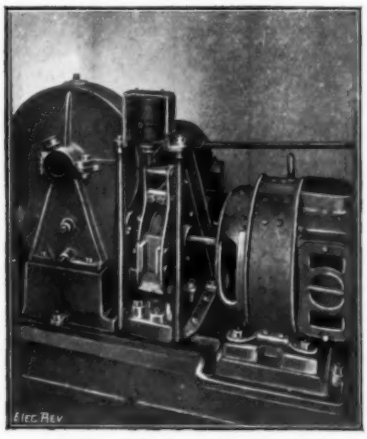


Fig. 4.—Haulage Gear for Sliding Roof.

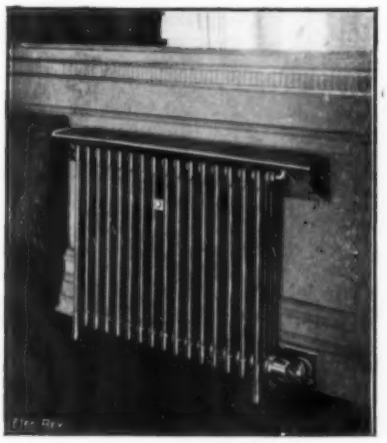


Fig. 5.—One of the Radiators.

thus bring the lights up to full intensity; they are electrically operated and controlled by five push-button

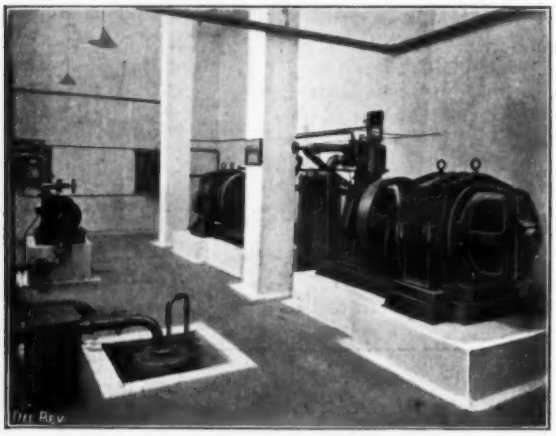


FIG. 6.—AIR-COMPRESSORS AND ARTESIAN WELL.

switches located in various parts of the house. The dimmers control 50 kW of the auditorium lighting. The curtains are automatically electrically controlled

FIG. 7.—MOTOR-GENERATORS AND SWITCHGEAR.

by push-button switches, the gear, &c., being driven by a 2-h.p. motor; the cams and contacts are arranged so

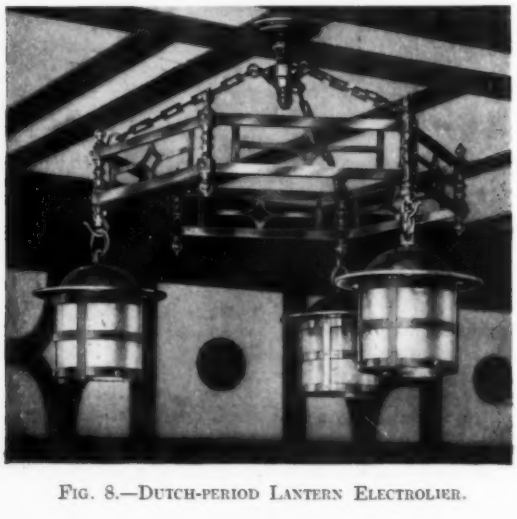


FIG. 8.—DUTCH-PERIOD LANTERN ELECTROLIER.

that the curtain lights are switched on and off as the curtain opens or closes. This gear was made by Messrs. Walturdaw.

Two Newton motor-generators, supplied by Mesars. Baxter & Caunter, are installed, one as a stand-by, each consisting of a 24-h.p., d.c., 200-volt motor, directly coupled to a 150-A, 50/100-V, d.c. generator, and mounted on a substantial iron bedplate. These

FIG. 9.—PROJECTORS.

machines are simply placed on 2-in. coco-nut mats without fixings of any kind, and the entire absence of vibration is very marked. Change-over switches are provided so that, if occasion arises, the motor-generators can be run from either supply company's mains.

The temperature rise of these machines, measured thermometrically after six hours' full-load run, was for

FIG. 10.—"EMPIRE" CANDELABRUM.

the armature 34 deg. F. and for the fields 42 deg. F. The generator fields are separately excited from the 200-V supply.

The Empire crystal lustre candelabra, 3-light bracket candelabra of the same period in the vestibule and lounge, the Dutch-period lantern electroliers and brackets in the saloon, flambeau torch brackets, and

Empire-design ceiling fixtures in the corridors, were designed and manufactured by Messrs. Peyton & Peyton, Ltd., Birmingham, and supplied by their London agents, Messrs. Sloan Electrical Co., Ltd.

The warming and ventilating of the auditorium is carried out on the "plenum" system, and all the air pumped into the auditorium is washed by being drawn through a spraying system of cold water operated by means of an electrically-driven pump. The air is then passed over a system of radiator tubes, heated by a battery of coke-fired boilers, and forced by means of electrically-driven blowers through steel ducts into the auditorium. To meet the London County Council requirements, this plant is capable of delivering 1,000 cu. ft. of fresh air per person per hour into the auditorium. Foul air is exhausted from various parts of the house by electrically-driven fans. The controllers of these fans are electrically interlocked with the main fresh-air motor controller, so that it is impossible to run the exhaust fans unless fresh air is being blown into the building, thereby maintaining a perfectly balanced system of ventilation. The blower motor is of 16 b.h.p., and is controlled by a starter regulator to control the speed of the motor. A separate circuit is run for each fan motor, and coloured pilot lights grouped and connected to each circuit automatically indicate that the fans are in commission. This installation was carried out by Messrs. Hargreaves, of Bolton.

The various offices, entrance hall, buffet, lavatories, &c., are heated by means of "Electrotherm" radiators, 35 of these of 0.5 to 2-kW capacity each being installed. They are arranged for three-heat control, and after they have been switched on for half an hour at the full load it is found that half load can be employed to maintain the temperature; the average loading is at the rate of 0.75 watt per cubic foot at full load.

The sliding roof consists of a heavy domed structure fitted with stained glass panels and mounted on ball-bearing rollers, which in turn run on rails fixed to the roof, the total weight being approximately four tons. The roof is moved by a main-and-tail haulage system. The gear, designed and made by the Berkeley Electrical Engineering Co., consists of a 2-h.p. series-wound reversing motor directly coupled to a wormshaft by means of a machined cast-iron coupling which also forms the brake drum. The worm reduction gear consists of a phosphor-bronze wheel with machine-cut teeth, the worm being of forged steel; the worm and wheel are totally enclosed in a cast-iron housing forming an oil bath; all bearings are bushed with gun-metal, and the thrust of the worm is taken by a special double-thrust ball bearing. On the worm-wheel shaft is keyed a cast-iron machine-moulded pinion which drives a machine-moulded spur wheel on a separate shaft, to which is keyed the winding drum, which has machined spiral grooves for the steel rope. The brake is of the electric solenoid type.

A Jardine "Orchestral" organ is installed, the Discus blower being driven by a 6-h.p. motor with an Igranic automatic starter controlled by a push-button switch on the organ console. The motor and electrical blowing plant are self-contained and fixed on steel channel framing.

Two artesian well pumps supply the whole of the water to the building, except in the fire hydrants, which are supplied from a special high-pressure main. There are two independent sets, each consisting of a compressor directly coupled to a 16-h.p. shunt-wound motor and capable of raising 2,000 gallons of water per hour 500 ft., which water is pumped into a tank at ground level; a centrifugal pump coupled to a Newton 6-h.p. motor pumps the water at the same rate to the supply tanks in the roof. Totally-enclosed Igranic automatic starters are employed for starting up the machines. The whole of this work was carried out by Messrs. Le Grand and Sutcliffe.

A complete plant by the British Vacuum Cleaning Co. is installed, driven by a 6-h.p. motor; piping is run to various parts of the house, where connections are provided to take the cleaning apparatus.

"Reliance" intercommunication 15-way telephones are provided, so that intercommunication can be effected between all parts of the house and the operating room, manager's office, and pay boxes.

Two Ross projectors are installed in the operating chamber above the balcony level. The electrical work is in conformity with the new Home Office regulations.

The specifications for the electrical work were provided by Mr. F. J. Humphrey, consulting engineer, the electrical contractors being the Berkeley Electrical Engineering Co., London.

The lighting of the building, owing to its being mainly of steel construction, presented some difficulties, and Mr. Humphrey is to be congratulated on the excellent effect produced. Mr. Norman, A.M.I.E.E., and his assistant, Mr. Rabbetts, engineers for the contractors, also deserve praise for the manner in which the electrical work has been carried out.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Australia.—Sydney.—December 12th. New South Wales Government Railways and Tramways. Rotary converter sets.*

November 21st. 1,000-kW sub-station units.*

December 5th. Transformers.*

December 19th. Sub-station transformers.*

City Council. January 7th. Coal-unloading and conveying plant.*

January 14th. 33,000-V step-up transformer.*

Melbourne.—January 3rd. Victorian Electricity Commissioners. Aluminium steel-cored cable and accessories. (October 26th.)

January 19th. Sub-station transformers, switchgear, and accessories. (October 26th.)

November 20th. Postmaster-General's Department. Telephone apparatus.*

December 19th. Victorian Railway Commissioners. Fibre for insulators.

Belfast. — November 19th. Electricity Department. Steam, water, and other piping, &c., at the Harbour power station. (See this issue.)

Belgium.—December 4th. The Deputation Permanente du Limbourg at Hasselt. Establishment of electricity distribution systems in the following districts:—Boucle du Canton de Bilsen, Maeseyck, Ophoven, Kessenich, and Kinroy, branches from Bochelt to Loozen and from Bree to Tongerloo, Overpelt, Exel and Hechtel, Beeringen-Eversel (Heusden) and the Canton of Herck-la-Ville; Hasselt and Curange, Alken, Cosen, Nieuwerkerken, and Melveren (Saint Trond), and Godscheid (Hasselt), and Diepenbeek. Particulars (15 fr.) from the Service Provincial d'Electricité, 27, Avenue Bamps, Hasselt.

November 10th. Municipal authorities of Saint Gilles, Brussels. Cast-iron terminal boxes, with circuit breakers and iron junction and distribution boxes. Particulars, 2½ fr.

November 14th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Supply of telephone apparatus. Particulars (Cahier des Charges Special No. 746) for 1¾ fr.

November 14th. Belgian Ministry of National Defence (3rd Direction), 10, Rue du Meridien, Brussels, are inviting tenders for telephone cable for the Telegraphists' Battalion. Particulars for 4 fr. (Cahier de Charges Special No. 339).

November 21st. Electric searchlights required for the Searchlight Battalion. Particulars (5 fr.) from Cahier des Charges Special No. 342.

November 21st. Telephone cable and accessories at Arlon. Particulars (Cahier des Charges Special No. 749) for 3 fr. 30 centimes.

November 22nd. Municipal authorities of Wanne (Province of Liége). Establishment of an electricity distribution system in the town.

Dublin.—November 12th. Great Northern Railway (Ireland). Stores, including electrical fittings, lamps, cable and wire, &c., for six months. (October 26th.)

Egypt.—Alexandria.—November 15th. Postal Administration. Stores, including lamps, &c.*

France.—PARIS.—Postal and Telegraph Department. 3-wire, paper-covered telegraph cable; 20,000 metres of 7-wire, paper-covered telegraph cable; 10,000 metres 14-wire, paper-covered cable. Particulars from 75, Boulevard Brune, Paris.

Glasgow.—November 6th. Deacon's Court of St. Enoch's U.F. Church. Heating installation (hot water or electricity) (1) for the church, and (2) for church and halls. Clerk of Deacon's Court, 38, Old Dumbarton Road, Glasgow.

Hastings. — Electricity Department. Water-softening plant. (October 26th.)

Liverpool.—November 12th. C. & A. Modes, Ltd. Installation of electric lighting at new premises in Church Street and Church and School Lanes. (October 19th.)

London.—PADDINGTON.—November 23rd. G.W. Railway. Stores, including telegraph instruments, cables, wires, lamps, apparatus, &c. (See this issue.)

Madagascar.—November 10th. Post and Telegraph Department. Copper wire, insulators, cells, and other accessories. Office Nationale du Commerce Extérieur, 22, Avenue Victor-Emmanuel III, Paris.

Manchester.—November 13th. Tramways Committee. Single-deck motor-'buses; tramcar trucks; tramcar motors; surfacing and screw-cutting lathe, 6 in. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

New Zealand.—AUCKLAND.—November 24th. Electric Power Board. Transformers and accessories.

The New Zealand Government is calling immediately for tenders, closing early next year, for the diversion of the Waikato River in connection with the Arapuni electric power scheme. It is estimated that the cost will approximate £500,000. Headworks and power-house plant will constitute the first tender. The site of the works is 140 miles from Auckland. The work is to be completed in three years.—*Reuter* (Wellington).

Preston.—November 26th. Electricity Department. Two 150-kW rotary converter equipments, h.p. and l.p. switchgear, h.p. cables. (See this issue.)

South Africa.—JOHANNESBURG.—Municipal Council. November 19th. Transformers.*

November 19th. Electric cables.*

CAPE TOWN.—November 29th. City Council. Transformers.*

Taunton. — November 16th. Electricity Department. One 1,000-kW steam turbine geared to a 1,000-kVA single-phase alternator, with exciter, and a 250-kW d.c. generator, complete with condensing plant, &c. (October 19th.)

Uruguay.—MONTEVIDEO.—December 27th. State Electric Light Works. Electrical supplies, including cable, insulating compound, lamp shades, &c.*

Warrington.—November 20th. Cheshire Lines Committee. Stores, including telegraph materials, for 12 months. Stores Superintendent, Cheshire Lines, Warrington.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—There was keen international competition for the recent contract of the municipal authorities of Antwerp for the supply of 15 electrically-operated 3-ton cranes. Eighteen tenders were submitted—eight Belgian, two Czecho-Slovakian, one French, five Dutch, and two German. The lowest offer was that of a Belgian firm, the Société Titan Anversois, of Hoboken, Antwerp. It may be mentioned that one of the German concerns quoted in both gold marks and American dollars, while the other submitted a price in gold marks, or, alternatively, Belgian notes.

Dundee.—The Corporation Electricity Committee has agreed to accept a German offer at £205, as against the British offer of £223, for the supply of cable.

Leek.—Urban District Council. Accepted:—

One 600-b.h.p. vertical enclosed gas engine (£5,200).—National Gas Engine Co., Ltd.
435-kW d.c. generator (£1,000).—Crompton & Co., Ltd.
Extension of switchboard (£238).—General Electric Co., Ltd.
One open water cooler (£100).—Premier Cooler & Engineering Co.

London.

Gasfilled lamps for three months (L.M. & S. Railway Co.). Vacuum and gasfilled lamps for four months (Southern Railway Co.).—Siemens and English Electric Lamp Co., Ltd.

Manchester.—Paving, &c., Committee. Accepted:—

Electric lighting installation at the Great Bridgwater Street yard.—J. Armstrong & Co. (Manchester), Ltd.

Waterworks Committee. Accepted:—

Cables in connection with the diversion of Mill Gill.—Macintosh Cable Co., Ltd.

Rugby.—Urban Council. Accepted:—

2½-ton electric scavenging vehicle (£995).—Richard Garratt & Son.
Mercury-vapour rectifier outfit (£183).—Hewittic Electrical Co., Ltd.

Salford.—Tramways Committee. Accepted:—

Materials, &c., for six months:—
Electric lamps.—Drake & Gorham (Wholesale), Ltd.; and General Electric Co., Ltd.
Gears and pinions.—British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Steel, Peech & Tozer, Ltd.
Armature coils and commutator spare.—P. R. Jackson & Co., Ltd.

Electricity Committee. Accepted:—

Four "Premier" wooden natural draught chimney cooling towers and two motor-driven pumping sets at Agecroft power station (£11,462).—Premier Cooler & Engineering Co., Ltd.
Pipework (£7,794).—J. Wolstenhome & Son, Ltd.

Sunderland.—Board of Guardians.

Transformer station and mains (£964); wiring at workhouse (£318), motors, and coupling them up (£320).—Reid, Ferens & Co.
Wiring at cottage homes (£257).—Watson, Norrie, Ltd.

FORTHCOMING EVENTS.

Motor Exhibition.—November 2nd to 10th. At Olympia, W.

Salford Technical and Engineering Association.—Saturday, November 3rd. At the Royal Technical College. At 7 p.m. Short papers by members of the Association for the gold medal awarded by Mr. W. O. Larmuth.

Society of Engineers.—Monday, November 5th. At Burlington House, Piccadilly, W. At 5 p.m. Paper on "Lubrication," by Mr. W. Lee.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 5th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Engineering Training," to be opened by the President, Dr. A. Russell.

(Western Centre).—Monday, November 5th. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Lecture on "The Mariners' Compass," by Prof. D. Robertson.

(Wireless Section).—Wednesday, November 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Inaugural address by the Chairman, Mr. E. H. Shaughnessey.

(North-Western Centre).—Tuesday, November 6th. At the Midland Hotel, Manchester. Chairman's (Mr. G. A. Juhlin) address and smoking concert.

(Mersey and North Wales (Liverpool) Centre).—Monday, November 5th. At the University, Liverpool. At 7 p.m. Chairman's (Mr. E. M. Hollingsworth) address.

Paisley Association of Electrical Engineers.—Tuesday, November 6th. At 39, High Street, Paisley. At 7.30 p.m. Paper on "Lesser-known Electric Utilities," by Mr. J. Orr.

Greenock Association of Electrical Engineers.—Tuesday, November 6th. At the Watt Hall, Greenock. At 7.45 p.m. Lecture on "Some Merits and Demerits of the Still Engine," by Mr. W. J. Still.

Institution of Civil Engineers.—Tuesday, November 6th. At the Institution, Great George Street, S.W. At 6 p.m. Presidential address by Sir C. L. Morgan and presentation of medals.

Rontgen Society.—Tuesday, November 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Presidential address on "X-Rays and the Atom," by Sir Oliver J. Lodge, F.R.S.

Institution of Heating and Ventilating Engineers.—Wednesday, November 7th. At the Engineers' Club, W.C. At 7 p.m. Paper on "Some Common Faults in Fan Design and Application," by Mr. F. G. Whipp.

Royal Society of Arts.—Wednesday, November 7th. At John Street, Adelphi, W.C. At 8 p.m. Inaugural address on "Exhibitions," by Lord Askwith.

All-British Wireless Exhibition.—November 8th to 21st. At the White City, Shepherd's Bush, W.

Chemical Society.—Thursday, November 8th. At the Institution of Mechanical Engineers. At 8 p.m. "Van der Waal's Memorial Lecture," by Dr. J. H. Jeans, Sec., R.S.

Electro-Harmonic Society.—Friday, November 9th. At Caxton Hall, Westminster, S.W. At 8 p.m. Ladies' night.

Physical Society of London.—Friday, November 9th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

REQUESTS for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of:—

Makers or suppliers of the SOLITE pendant fitting.
URSA refrigerator.
RUMPLER refrigerator.
NATURALITO artificial daylight lamp.
COMMUDINE commutator fluid.
COSY GLOW fires.
BAKELITE mouldings.

NOTES.

Freemasonry.—At the installation meeting of the Kelvin Lodge, on October 26th last, Mr. Andrew Forbes Dick was installed as Master for the ensuing twelve months, and at the banquet which followed he was well supported by his officers for the year as well as by a large muster of the members of the lodge and their guests, including Mr. Charles F. Quicke, Mr. F. P. Baxter, Major Pike, Mr. L. E. Wilson, Mr. Gillespie, Mr. Hobdell, Mr Ellis, and many other gentlemen well known in the electrical and engineering professions, the total attendance numbering 111, and the evening being most enjoyable.

Destructive Boiler Tests.—The annual memorandum just issued by Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, deals with three destructive steam boiler tests which the Association carried out in order to settle the oft-repeated question whether wrought iron deteriorates with age. Some authorities had decided that boiler pressures should be reduced several pounds every year even from the start, whereas this Association has never reduced the pressure of any boiler under its care, no matter how old it might have been unless, of course, wasting had actually occurred. The correctness of this policy has been fully confirmed by the above-mentioned exhaustive tests. A large number of the tests were, with the permission of the Victoria University authorities, and Prof. Gibson, made in the Engineering Laboratory of the University, and demonstrated that iron does not deteriorate with age. Owners of old wrought-iron boilers need, therefore, have no fear that their pressures must be reduced, unless, of course, they have suffered waste and corrosion, and owners of steel boilers should take the greatest possible care of them, for boilers of that material (steel) should be capable of lasting for many years, if not for ever.

In continuation of past practice, the memorandum also enters into analyses of the causes of certain explosions. This time the weaknesses of dished boiler end plates are discussed. The memorandum concludes with an interesting review of the important object of energy storage. It is mentioned incidentally that to store one horse-power-hour requires about 30 pounds weight of ordinary electric storage batteries, or 50 pounds of nickel iron batteries, or 30 pounds of thermal storers. Thermal storers are large cylindrical vessels filled with water into which steam is blown when there is a surplus production, being drawn off again when there is a heavy demand. Thus with their help one boiler working night and day could supply all the steam which three boilers would have to supply during working hours. Peak loads in power stations can be surmounted, and in bleach and dye works thermal storers can be made to supply pure hot water.

Service Notes.—The Admiralty has ordered the present practice of drafting active service telegraphists from the naval depôts for service in dockyard tugs to be discontinued. These men are to be replaced by civilians who are ex-naval telegraphists and not in the Reserve, or else by other competent civilian operators. They are to be employed under the general conditions applicable to yard craft ratings. One operator will be allowed at Portsmouth, Sheerness, Devonport, and Rosyth to maintain the wireless installations of the tugs, and to embark in any tug detailed for outpost service. The operator engaged for service at Sheerness will be available for service at Chatham as required.

Appointments Vacant.—Lecturer in Wireless Telegraphy (evening), for the Borough Polytechnic; meter repairer (67s.), for the Darwen Borough Council electricity department; foreman electrician (Rs. 500) for the Bombay, Baroda and Central Railway. (See our advertisement pages to-day.)

Lectures.—The Lighting of Buildings.—Discussing "The Lighting of Buildings" at a large gathering of students and members of the Architectural Department of the Northern Polytechnic, London, Mr. Lawrence M. Tye reviewed illuminating progress and dealt with the various sources of light. The advantages and limitations of each were explained, as also were the various methods of wiring suitable for house work and public buildings. Mr. Tye referred to the various types of illuminating glassware, showing that considered from the aspect of efficiency direct lighting came first, semi-indirect required approximately 50 per cent. more energy to get the same illumination intensity on the working plane, and indirect lighting required approximately 100 per cent. more energy, given similar reflective coefficients for walls and ceilings in each case.

Cast-iron Research.—The Director of Research of the British Cast-iron Research Association, Dr. P. Longmuir, has resigned through ill-health. Increasing interest in the work of the Association is being shown by members, and several new problems have been put forward recently.

Local Societies.—Mining Electrical Engineers.—Mr. W. T. Anderson, of Manchester, president of the Association of Mining Electrical Engineers, who attended a meeting of the Midland Branch and distributed prizes at Nottingham on Saturday, touched upon the importance of district work, and hoped that during his year of office the membership of the organisation might be increased to over 2,000.

Electric Motors.—At the Birmingham and District Electric Club, on October 26th, a paper was read by Mr. Henry Joseph, A.M.I.E.E., on "Electric Motors in Service," in which there was a considerable amount of criticism of the design of modern motors. It was suggested that the craze for mere cheapness in small motors had seriously militated against reliability.

A Minister of Science.—Addressing the Birmingham University Metallurgical Society on Tuesday last, on metallurgical science, Sir Robert A. Hadfield said that the importance of science to the nation demanded a Minister of Science. He believed that immense advantages would result from the establishment of such a Ministry; science was glorified during the war, but had again been relegated to a secondary position. Germany had acquired a reputation for scientific progress, but it was founded on discoveries made by men in other countries, who had used them only as stepping-stones to further research in pure science, whilst Germany adopted them and applied them to commercial development.

The Thomas Turner Gold Medal for metallurgical advances was presented to Sir Robert, who was the first to receive this distinction.

The National Joint Industrial Council for the Electricity Supply Industry.—The members of this National Council entertained their chairman, Alderman W. Walker, to dinner upon the occasion of his re-election as chairman of the National Council for the fifth year in succession. The dinner was held on October 18th, and was fully attended. Mr. J. Rowan, J.P. (E.T.U.), vice-chairman of the Council, presided, and the proceedings were of the happiest character. During the evening the following telegram was sent to the Rt. Hon. J. H. Whitley, M.P., Speaker of the House of Commons, the author of the Whitley movement:— "All parties in National Joint Industrial Council for Electric Supply Industry now dining together in honour of their chairman, Alderman Walker, have pleasure in greeting you and offering you their congratulations on the success of this Whitley Council."

The following reply was received from Mr. Whitley:—"It was a very real pleasure last night to receive the telegram from the members of your Council assembled at dinner, and to hear of the gratifying success of your work together. I trust that harmony for the good of your industry may long continue."

United States Electric Vehicle Market.—After a lull of several weeks, business in the electrical vehicle market is beginning to show signs of improvement. Four truck manufacturers reported that they had each sold from one to four vehicles during the month. One truck manufacturer, who advertises more extensively than his competitors, is enthusiastic with regard to business during the coming season. A most important feature of the Electrical and Industrial Exposition, which opened here on October 17th, and will close on October 27th, is the display of electric trucks and accessories. The Steinmetz Electric Truck Co. exhibited a one-ton delivery wagon, with specially-designed body, which has been driven over 104 miles on a single battery charge, carrying 660 lb. and three men. This truck is capable of attaining a speed of from 16 to 18 miles an hour with a full load, and approximately 20 miles an hour unloaded. The Commercial Truck Co. exhibited a two-ton chassis and a one-ton body delivery truck; the Walker Electric Vehicle Co. showed a chassis and a three-quarter ton truck; the Walter Electric Truck Co., the Autocar Co., and the O. B. Electric Co. also exhibited trucks.

The first number of the Electric Transportation News *Bulletin* was issued here on October 5th by the Electric Transportation Committee of the National Electric Light Association. The *Bulletin*, which will be published half-monthly, is mainly devoted to items on the electric truck industry, and copies are being distributed to the leading papers in the country.

Eight electric trucks and passenger cars, valued at 26,835 dollars, were exported from the United States during August, 1923, against four, valued at 7,456 dollars, in August, 1922.—*Reuter's Trade Service.*

Register of Electrical Contractors.—The Board of Trade has received an application for a licence authorising the registration of an association to be styled "The National Register of Electrical Contractors," the objects of which are: To afford to the public the means of distinguishing electrical installation contractors who shall have given evidence of their competency, and undertaken the responsibility required by the conditions of registration under the powers contained therein; and for the foregoing purposes to set up, issue and maintain a register for Great Britain, the Irish Free State, and Northern Ireland, of electrical installation contractors qualified for registration under the rules and regulations for the time being of the Association, and to issue certificates of registration thereunder.

A New Journal.—We have received the first number of the new monthly Journal of Scientific Instruments, which is being produced by the Institute of Physics, with the co-operation of the National Physical Laboratory. Its purpose is to describe methods of measurement, and the construction and use of instruments used in all branches of scientific and technical work, and it is the first publication of its kind in this country. It will appear on the 15th of each month, price 2s. 6d. a number, and may be obtained from the Institute of Physics. The current issue contains a number of highly technical articles on physical subjects, including one by Mr. H. A. Thomas on a new relay and its application to sustaining pendulum vibrations.

The Electrical Trades Benevolent Institution.—There is still ample time to secure tickets for the Annual Festival, which will take place on Wednesday, November 14th. Sir Philip M. Nash will preside, and ladies are invited to be present. But if attendance at the dinner is not possible, a cheque for any amount up to £50,000 will be gladly accepted by the Hon. Secretary, Mr. F. B. O. Hawes, A.M.Inst.C.E., 18-21, Park Mansions, Vauxhall Park, S.W.8.

Pellet Oxide-Film Lightning Arresters.—The oxide-film lightning arrester is claimed to have been remarkably successful. A modification of this type is now announced by Mr. N. A. Lougee in the *Journal* of the A.I.E.E. for September last. Briefly, pellets of lead peroxide, the chemical powder used in the present "OF" type, are made and coated with an insulating film of powder. They are simply poured in an insulating tube, terminals put on each end in contact with the pellets, a series gap added, and the arrester unit is complete. In action, each pellet is a miniature "OF" cell, so the arrester tube contains a number of them in series and parallel. The over-voltage surge discharges through the pellets, which have a low resistance after the powder film is punctured, and sealing occurs at the contact of the various pellets. No dynamic or normal frequency current passes. The characteristics are similar to those of the present "OF" arrester, giving it the fundamental characteristics a successful arrester must have. The pellet construction permits of a simple, flexible and comparatively cheap design.

Gas v. Electricity.—Mr. Len. H. Thomas (Birmingham Gas Works) delivered his presidential address, on October 18th, at the opening meeting of the session of the Midland Junior Gas Association, Birmingham, before a very large attendance of members. Alluding to the competition from electricity he urged the need of gas engineers losing no opportunity of demonstrating the cheapness and suitability of gas, compared with electricity in most districts. He pointed out that the building of super-power stations, where electricity was to be produced for a half-penny per unit, necessitated a big increase in output, and the electricity supply companies were making great efforts to push the use of electricity. As gas engineers they acknowledged that there were many duties which could be better fulfilled by electric motors than by any other kind of power plant. Their ease in starting, the smallness of the plant for a given power, the small attention required, their superiority for travelling machines, were all factors which made them more suitable under certain conditions than gas, oil, or steam engines. In the gas industry they acknowledged that by installing electric motors on many plants.

When electricity could be produced by water power, or by waste heat, or by exhaust steam, it might be produced sufficiently cheaply to be exclusively used in a district, but so long as only 45 to 60 therms of heat could be produced from a ton of bituminous coal by conversion to electricity and nothing but ashes remained, and they could produce 70 to 80 therms as gas and 140 to 150 therms as coke from a ton of coal, and all the vast products of tar and ammoniacal liquor remained, it could never be truly said that the conversion of coal into electricity was a part of the national ideal of conserving our coal measures.

These figures were based on a medium-class coal, such as was used in gas works; usually electric generating stations were run on a poor fuel, often slack mixed with coke breeze, but the erection of many super-power stations would necessitate the use of a higher grade of fuel. The cost of electricity was reduced by using a poor-class fuel, but when considering the thermal efficiency of generation it was only fair to allow similar fuels.

When they considered the question of heating, electricity could not compete except under exceptional circumstances. There were a few industrial processes which could only be carried out by means of the electric furnace, but the majority of heating operations could be performed as well by the gas furnace, as by any other type of furnace.

Another use for gas which was being developed, and should be still more so, was the use of town's gas for generating electricity for lighting public buildings and large stores. There were many advantages in the use of electric lighting in these places, and when those in authority decided that these advantages were such that they would install electric lighting, they would be able to prove to them that, instead of paying the high rates for electricity for lighting, they could supply them with gas at the lower power rates, and they would be able to produce their current at lower cost than they could buy it at from most electricity supply stations. That again would help their load factor by increasing the night load.

Miners' Nystagmus.—It is reported that in Ebbw Vale Collieries, Monmouthshire, miners' nystagmus, a disabling eye disease, has been relieved by the use of canary yellow glass in the safety lamps.—*Evening News.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—IRISH CENTRE.—At the inaugural meeting in Dublin of the 1923-24 session of the Irish Centre of the Institution, Mr. R. N. Tweedy, who succeeds Mr. E. C. Hancock as chairman, delivered an interesting address, in the course of which he claimed that engineers were, in the main, better fitted by their training than the majority of other classes to stabilise public opinion by sound judgment. This claim might not be admitted by the other classes, but it ought to do the engineers good to believe it themselves and it would react favourably on the rest of the community if they endeavoured to prove it in practice. The welfare of their profession was bound up with the welfare of industry and the State lived, languished, or died as industry flourished, stagnated, or decayed. If they realised their responsibilities in that connection they should feel more particularly urged to lend a hand in setting right that which was so fundamentally wrong.

Ireland had had more than its share of civil war, but the economic civil war between employers and employed was far more serious, because it was perpetually sapping the social structure. The only remedy for such a condition was light and the only generator of light was honesty.

With regard to a national electric power scheme, Mr. Tweedy's belief was that the financial credit of Ireland depended largely upon the adoption of a power policy. He was more strongly convinced of that than ever. The way in which the River Liffey power scheme was handled by the Free State Government was of enormous importance to the country. The scheme was the first undertaken in the Free State, and he trembled to think of the national issues that hung upon it. He was not at all happy in the thought that the Government might be content rather to await the outcome of the silent struggle between the several interests involved than to tackle resolutely the problem of which this scheme should be part.

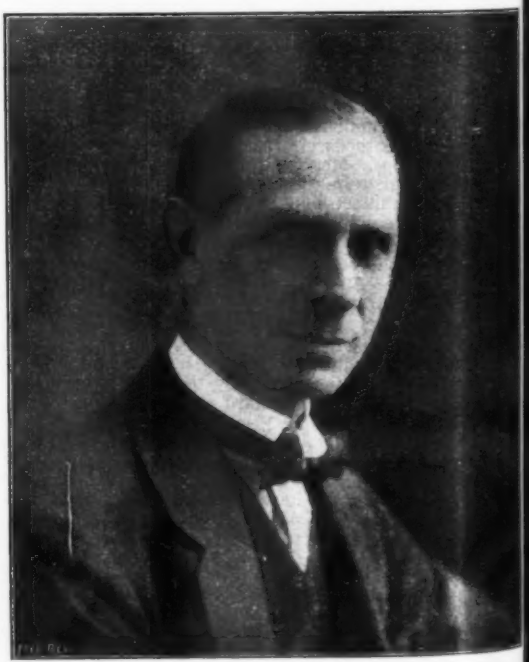
Röntgen Society.—On Tuesday, November 6th, at the Institution of Electrical Engineers, Victoria Embankment, at 8.15 p.m., Sir Oliver J. Lodge, F.R.S., will deliver his presidential address on "X-Rays and the Atom."

Association of Consulting Engineers (Incorporated).—The annual dinner of the Association will be held at St. Stephen's Club, Westminster, on Wednesday, November 21st, at 7.0 for 7.30 p.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. G. A. JUHLIN, who is to read his address, as chairman, to the North-Western Centre of the Institution of Electrical Engineers on November 6th, received his early education at the Stockholm Technical College. His first appointment was that of designer of a.c. and d.c. machines at the works of



Elliott & Fry] [*London*

MR. G. A. JUHLIN,
Chairman of the North-Western Centre of the I.E.E.

Messrs. Dick, Kerr & Co., Preston, and he was appointed chief a.c. designer in 1907, a post which he retained until 1915, when he joined the Metropolitan-Vickers Electrical Co., Ltd. Since 1917 he has held the position of chief engineer of the Plant Department of the company's works at Trafford

Park, Manchester. Thus for over twenty years Mr. Juhlin has been closely associated with the development of electrical machinery, especially turbo-alternators and rotary converters. we believe we are correct in saying that he was responsible for the first 1,250-volt rotary converters built in this country (for the L. & Y. Railway, Manchester-Bury line). His paper upon "The Temperature Limits of Large Alternators," read before the I.E.E., gained him the John Hopkinson premium of that Institution. He has also contributed a paper on "The Regulation of Rotary Converters" to the Institution's proceedings, and is one of the regular participants in the discussions at I.E.E. meetings.

Mr. Juhlin was for some years a member of the American Institute of Electrical Engineers, but severed his connection with that body during the war. From time to time he has served on B.E.S.A. and B.E.A.M.A. standardisation committees, where his experience has been of great value.

At the Aylestone generating station of the Leicester electricity department, on October 24th, Mr. W. E. Barton, station superintendent, was presented with a gold-mounted ebony walking stick, together with an umbrella for Mrs. Barton. The presentations were made by two employés who had been longest in the service of the department. Mr. Barton, who went to Bolton in 1894, is retiring because of ill-health.

On October 24th the Manchester Tramways Committee accepted the resignation (to take effect in December) of Mr. James Wood, the assistant manager of the department and financial superintendent. The committee placed on record by resolution its high appreciation of the services of Mr. Wood, who had been in the department since it started twenty-three years ago. His public service in this and other capacities has extended over 51 years.

Mr. T. P. Wilmshurst, municipal electrical engineer at Derby, has just completed 25 years' service with the Corporation.

Chester City Council has granted £500 to Mr. S. E. Britton, city electrical engineer, in recognition of services carried out in recent years in the capacity of consulting engineer.

It was announced at the last meeting of the Diesel Engine Users' Association that Mr. Percy Still, who had held the office of honorary secretary of the Association since 1914, had felt obliged to ask the committee to make arrangements to relieve him of his duties after the end of the current year as he found that the great growth in the work in recent years was taking up too much of his time. The President remarked that when Mr. Still took up the duties of honorary secretary over nine years ago there were about 30 members, whereas at the present day the total membership ran into about 400. The committee had already given the matter their careful consideration, and they were hopeful that before the next meeting of the Association they might be in a position to put forward a suggestion under which the work might perhaps be carried out by joint honorary secretaries. They hoped that under such an arrangement the services of Mr. Still might be retained by the Association.

Mr. W. E. Claret, A.M.I.Mech.E., A.M.I.E.E., chief engineer of the West Riding County Asylum, Wakefield, has been appointed lecturer on "Smoke Abatement and Fuel Economy" for a course of 20 lectures to boiler-house workers, &c., to be delivered at the Wakefield City Technical Schools.

Mr. G. K. Blatchford, the new Mayor of Okehampton, Devon, is proprietor of the electricity supply works of the town.

We understand that Mr. L. Henshaw, A.M.I.M.E., M.I.E. (Ind.), the electrical engineer, Public Works Department, Madras, has left India on long leave, which he intends spending in England.

Sir J. Fortescue Flannery, Bart., M.Inst.C.E., M.I.Mar.E., &c., has accepted the invitation to become president of the Junior Institution of Engineers in succession to Capt. H. Riall Sankey. On Friday, December 7th, he will deliver his presidential address on "Marine Propulsion During 50 Years."

Mr. A. Moreton Scales, lately sales manager of Messrs. A. C. Alexandra, Ltd., has joined the Anglo-Austrian Electric Lamp Works, Ltd., in a similar capacity.

Obituary.—Dr. C. P. Steinmetz.—Dr. Charles Proteus Steinmetz, the eminent electrical engineer and scientist of international reputation, who was born in Breslau, Germany, in 1865, and had been for very many years resident in the United States, died suddenly at his home in Schenectady, on Friday last, October 26th. When he was seventeen years of age he entered Breslau University for the study of mathematics, electrotechnics, chemistry and other subjects. He next proceeded to Berlin, but the records show that his stay there was short, as he found it advisable "for political reasons" to leave Germany. In 1888, therefore, he found his way to the Zurich Polytechnic School, where he followed the study of mechanical engineering. A year later he proceeded to the U.S.A., and it was there that his world-wide electrotechnical reputation was built up. Though it is often said that science is international, the revolting attitude of German scientists during the war temporarily cancelled this understanding, and unfortunately in the U.S.A. Dr. C. P. Steinmetz did not refrain from expressing opinions which were most unfriendly to the Allies. This pro-German attitude, however, does not affect the electrotechnical pre-eminence of Dr. Steinmetz. He left Switzerland for the States in 1889, becoming connected with the Eickemeyer interests, and four years later, when these interests were consolidated with those of the General Electric Company, he joined the latter organisation as consulting engineer and removed to Lynn, Mass., changing subsequently to Schenectady. He was professor of electrophysics in Union University, New York. The *Times*, in referring to his record, says:—"Dr. Steinmetz's researches in electrical phenomena were embodied in a series of books, published between 1897 and 1917, some of which have gone into several editions, and in many papers and monographs. He was a past president of the American Institution of Electrical Engineers and the Illuminating Engineering Society, and at Schenectady, New York, where he had his private laboratory, he took part in local educational and administrative affairs. Dr. Steinmetz believed that the future of civilisation depended on the transmission of electrical power, just as the problem of the nineteenth century was that of railway transport. He advocated the development in the United States of a nation-wide supply of electrical energy, under Federal control. This, he considered, would involve a centralised direction, and also the right of 'eminent domain' such as is enjoyed by the railways. He had long been convinced, too, of the necessity of obtaining fixed nitrogen from the air—indeed, he used to say that the human race would starve to death unless it could put back into the soil supplies of nitrogen equivalent to those extracted from it by agriculture."

The Late Dr. C. P. Steinmetz.

M. Maurice Leblanc.—We learn with deep regret of the death, which occurred on Saturday last, of M. Maurice Leblanc, who was president of the International Electrotechnical Commission meetings held in London in October, 1919. A photograph of M. Leblanc appeared in the Electrical Review for October 24th, 1919, p. 522, together with a report of an interesting address delivered by him before the meeting of the above Commission.

Mr. V. Mallalieu.—The funeral took place at Cheadle Hulme on Friday last of Mr. Vernon Mallalieu, who was killed as the result of an accident at the Reedyford Mill, Nelson. He was examining some motors when he stepped on some asbestos covering and fell through for a distance of several feet. At the inquest on October 25th a verdict of "Accidental Death" was returned. An authority on electrification schemes in the textile industry, he was for many years on the staff of the Metropolitan-Vickers Co., Ltd., in this connection, and latterly served with the English Electric Co., Ltd. Mr. Mallalieu, who was an associate member of the I.E.E. and a member of the Textile Institute, was 37 years of age. He leaves a widow and two young children.

Mr. W. Underwood.—We learn with regret that Mr. William Underwood, managing director of Underwood (Manchester), Ltd., passed away on October 29th after a short illness from pneumonia.

Will.—The late Mr. J. H. Tritton, chairman of the Indo-European Telegraph Co., Ltd., left £199,118 gross and £170,022 net personalty.

NEW COMPANIES REGISTERED.

Halcyon Wireless Supply Co., Ltd. (193,277).—Private company. Registered October 23rd. Capital, £2,000 in 1,950 ordinary shares of £1 each and 1,000 deferred shares of 1s. each. To carry on the business of manufacturers of, and dealers in wireless, electric, magnetic, telegraphic, telephone, and other appliances, machines and apparatus, model and toy makers and dealers, &c. The first directors are:—A. S. Marks, 24, De Vere Gardens, W.8; B. A. Emby, 24, De Vere Gardens, W.8. Solicitors: Kennedy, Lindo & Co., 79, Coleman Street, E.C.2.

Taylor's Radio Electric, Ltd. (193,310).—Private company. Registered October 24th. Capital, £500 in £1 shares. To carry on the business of radio specialists, wireless and electrical engineers, &c. The subscribers (each with one share) are:—F. B. Taylor, 146, King's Road, Cardiff, law clerk; A. Taylor, 146, King's Road, Cardiff, radio engineer. F. B. Taylor is permanent governing director and chairman. Solicitor: E. Horley, Andrew's Buildings, 67, Queen Street, Cardiff.

Sea Houses and District Electric Supply Co., Ltd. (193,286).—Registered October 23rd. Capital, £5,000 in £1 shares. To carry on business as indicated by the title. Minimum cash subscription, £500. The first directors are:—W. A. Woodeson, "Novar," Chowdene Bank, Low Fell, Gateshead-on-Tyne; W. J. Swallow, "Inglewood," Three Mile Bridge, Gosforth, Newcastle-on-Tyne; J. McLaren, "Ivy Cottage," North Sunderland, Northumberland; T. Rutherford, "Wisp Low," Osborne Road, Newcastle-on-Tyne; W. A. Matthews, Front Street, Sea Houses; A. Andrews, "Glenavon," 78, Moorside, Fenham, Newcastle-on-Tyne; F. H. Hall, North Sunderland, Northumberland. Qualification, £100 shares. Secretary (*pro. tem.*); L. B. Ross. Registered office: The Power Station, Sea Houses, Northumberland.

New Armature Co., Ltd. (193,136).—Private company. Registered October 17th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers and repairers of railway, tramway, electric, magnetic, galvanic, and other apparatus, &c. The permanent directors are:—J. Hughes, "The Firs," Gorseinon, ironfounder; W. S. Williams, Brycoed House, Tyideunow, Landore, engineer; J. H. King, 6, Osborne Terrace, Brynmill, Swansea. Qualification of permanent directors, 100 ordinary shares; of ordinary directors, £50. Remuneration as fixed by the company. Secretary: J. H. King. Solicitor: C. W. Slater, 18, York Place, Swansea.

Melide, Ltd. (193,110).—Private company. Registered October 16th. Capital, £100 in £1 shares. To carry on the business of electrical and mechanical engineers, machinists, fitters, millwrights and founders, manufacturers of wireless, electrical, and other implements and machinery, &c. The subscribers (each with one ordinary share) are:—Miss G. C. Cadogan, 39, Wakehurst Road, Wandsworth Common, S.W.11; W. G. Hollister, 138a, Minories, E.C., clerk. The subscribers are to appoint the first directors. Qualification, one share. Solicitors: De La Chapelle, Bartlett and Co., 34/6, Gresham Street, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Park Royal Engineering Works, Ltd.—J. Davie, of 3, London Wall Buildings, E.C., was appointed receiver on October 19th, 1923, under powers contained in trust deed dated May 5th, 1914.

British Radio Sales Co., Ltd.—J. J. Bamberger, of St. Stephen's Buildings, Gresse Street, Tottenham Court Road, W.C., was appointed receiver and manager on September 12th, under powers contained in debenture dated August 18th, 1923.

Adams Brothers (Longton), Ltd.—Debenture bond dated October 4th, 1923, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holder: F. A. Spruce, Grindley Lane, Blyth Bridge, Staffs.

Orford Electric Light and Power Co., Ltd.—Particulars filed on October 19th of £7,500 debentures authorised July 9th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £100.

Oxford Electric Co., Ltd.—Satisfaction to the extent of £25,000 (being amount issued) on August 14th, 1923, of second debentures, dated July 17th, 1920, securing £50,000.

South Metropolitan Electric Light and Power Co., Ltd. (47,875c).—Return dated March 14th, 1923. Capital, £500,000 in 250,000 ordinary, 150,000 7 per cent. cumulative first and 100,000 6 per cent. cumulative second preference shares of £1 each. 165,000 ordinary, 150,000 first preference, and 100,000 second preference shares taken up. £1 per share called up on 162,500 ordinary, 144,632 1st preference, and 100,000 2nd preference shares. £407,132 paid. £7,868 considered as paid on the remainder. Mortgages and charges, £374,090.

Kalgoorlie Electric Power and Lighting Corporation, Ltd. (91,219).—Return dated August 2nd, 1923. Capital, £50,005 in five preference shares of £1 each and 100,000 ordinary shares of 10s. each. 100,000 ordinary shares taken up. £3 10s. paid. £49,996 10s. considered as paid. Mortgages and charges, £150,000.

Glantawe Electric Supply Co., Ltd. (112,615).—Return dated October 5th, 1923. Capital, £15,000 in £10 shares. All shares taken up. £15,000 paid. Mortgages and charges, nil.

British Battery Co., Ltd. (137,905).—Return dated June 19th, 1922 (filed September 12th, 1923). Capital, £1,000 in 800 preference and 200 ordinary shares of £1 each. 800 preference and 199 ordinary shares taken up. £999 paid. Mortgages and charges, £700.

Coniston and District Electric Supply Co., Ltd. (138,478).—Return dated December 31st, 1922 (filed September 20th, 1923). Capital, £2,000 in 1,500 6 per cent. preference and 500 ordinary shares of £1 each. 1,440 preference and 500 ordinary shares taken up. £1,660 paid on 1,440 preference and 220 ordinary shares. £280 considered as paid on the remainder. Mortgages and charges, nil.

West India and Panama Telegraph Co., Ltd. (11,116).—Return dated June 20th, 1923. Capital, £2,445,630 in 34,563 1st preference, 10,000 2nd preference, and 200,000 ordinary shares of £10 each. 34,563 1st preference, 4,669 2nd preference, and 88,321 ordinary shares taken up. £1,275,530 considered as paid. Mortgages and charges, £89,600.

W. Sisson & Co., Ltd. (82,295).—Return dated July 31st, 1923. Capital, £50,000 in 5,000 preference, 38,000 ordinary, and 7,000 deferred shares of £1 each. 4,375 preference, 31,711 ordinary, and 7,000 deferred shares taken up. £28,686 paid on 4,375 preference and 24,311 ordinary shares. £14,400 considered as paid on the remainder. Mortgages and charges, nil.

Hindhead and District Electric Light Co., Ltd.—Issue on October 11th, 1923, of £250 debentures, part of a series already registered.

North Melbourne Electric Tramways & Lighting Co., Ltd.—Satisfaction in full on October 16th, 1923, of charge dated December 15th, 1905, securing £200,000.

Musselburgh & District Electric Light & Traction Co., Ltd.—Satisfaction to the further extent of £1,200 on October 12th, 1923, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000.

Star Lamp Co., Ltd.—Satisfaction in full on October 15th of debentures dated February 7th, 1923, securing £1,500.

Debenture dated October 15th, 1923, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holders:—W. E. Martin, Westminster Lodge, St. Albans; and G. J. Gully, 35, Croydon Road, Penge.

CITY NOTES.

Amalgamated Wireless (Australasia), Ltd.

At the annual meeting of this company, held on August 31st, Mr. G. MASON-ALLARD expressed the regret of the directors that they were unable to recommend a dividend. The company was passing through an exceptional period. It had recently changed its status in that the Government had joined with the company for the purpose of undertaking the very large scheme of direct high-power wireless communication with the rest of the world, a scheme which had also called for a considerable amount of expenditure. During the year (says the *Sydney Morning Herald* report of the speech) the gross profit, which amounted to the sum of £68,000, was in excess of the gross profit from the ordinary service of the previous year by approximately £5,000, and by still more in comparison with that of the year ended June 30th, 1921—£59,000. The expenses, however, increased to nearly £62,000, which was approximately £15,000 greater than last year. That was accounted for to a considerable extent by a factor from which many trading concerns had suffered, namely, diminishing values in the world's markets, in all classes of productions and manufactures, and in common with other concerns the company had suffered. The directors had taken the opportunity of putting the company's stocks on proper financial footing. There had also been considerable current expenditure from which no immediate returns could be obtained. There had been a reduction on investments, such as War Loans and deposits. The capital had been employed in preparing for the several new enterprises the company was now engaged upon. Mr. Allard added that there would be a call on contributing shares at an early date to carry out their big work.

Electrolytic Zinc Co. of Australasia.

The annual meeting of this company was held in Melbourne on October 30th. According to information cabled to this country, the report to come before the meeting showed that the gross profit for the year ended June 30th, after writing £20,000 off investigational research and general development account and carrying £90,000 to reserve for depreciation, was £401,808 (against £93,841 for the preceding year), in which period the plant was only in operation for seven months. According to *The Times*, after adding £2,614, representing income from property and sundry receipts, and deducting profit and loss items, including £48,000 as provision for income taxes, the net profit was £285,406. Adding £76,593 brought forward, there was an available balance of £361,999. This has been disposed of by writing off preference shares and debenture issue expenses, £74,482; by providing for co-operative council activities at Risdon, £7,500; by carrying to debenture sinking fund reserve, £12,640; by carrying to equalisation reserve, £40,000; and by the payment of dividends Nos. 1 and 3, £149,115, leaving a balance of £78,262 to be carried forward. The output was 31,283 tons electrolytic zinc; silver-lead product containing 4,344 tons lead and 691,052 oz. silver. The plant was completed during the year, and further installations to ensure ample supplies and accumulate a reserve are being proceeded with. The above dividends, together with No. 4 paid in September last, cover the full amount accrued to June 30th, 1923, on all preference shares issued as well as an amount representing 8 per cent. on the ordinary shares for the half-year ended June 30th.

Italian Companies.

The following Italian companies have increased their capital:—The Società Anonima Elettricità Alta Italia, of Turin, from 48,000,000 to 125,000,000 lire, by the issue of 208,000 250-lire shares; the Società Idroelettrica Resetti, of Milan, from 150,000 to 1,500,000 lire, by the issue of 13,500 new shares of 100-lire each; the Società Idrotermoelettrica Calabria, of Turin, from 350,000 to 1,200,000 lire; the Società Forza Elettrica Valeggio sul Mincio, from 800,000 to 2,000,000 lire; and the Società pergli Infanti Idroelettrica del'Alto Serie, of Milan, from 100,000 to 1,000,000 lire.

The Società Elettrica Negri, of Genoa, has reduced its capital from 110,000,000 to 55,000,000 lire, divided into 550,000 shares of 100-lire each.

French Companies.

The *Société l'Electro-Cable* records net profits of 3,098,000 fr. for the year 1922-23, as contrasted with 2,543,000 fr. in the previous year. It is expected that the dividend will be at the rate of 30 fr. per ordinary share.

The *Compagnie Générale d'Electricité* reports net profits of 9,429,000 fr. for the year ended with June 30th, 1923, or 343,000 fr. more than in the preceding year. It is proposed to pay a dividend at the rate of 60 fr. per share, as in 1921-22.

The *Compagnie Electro-Metallurgie*, of Dives, is credited with net profits of 4,500,000 fr. for the year ended last June, this comparing with 3,266,000 fr. in the previous year. The dividend, at the rate of 60 fr. per share, which was paid for 1921-22, is to be maintained for the past year.

The *Société d'Appareillage Electrique Grivolas* is stated to have incurred a loss of 1,716,000 fr. in the year ended with last March, as compared with 2,970,000 fr. in the previous year.

The accounts of the *Societé des Accumulateurs Dinin* indicate gross profits of 2,581,000 fr. for 1922-23, as contrasted with 1,733,000 fr. in the previous year. The net profits and balance forward amount to 2,581,000 fr. and the rate of dividend is to be 12 fr. per share or twice the rate paid in 1921-22.

The gross profits of the *Maison Breguet* in the year ended last April are returned at 5,933,000 fr., as compared with 5,333,000 fr. in the previous year. The net profits are 2,158,000 fr. and 1,866,000 fr. in the two years respectively, and the dividend rises from 50 fr. per share in 1921-22 to 60 fr. for the last year.

Prospectus.

London Tube Railway Issues.—The list opened on Monday last and was announced to close on or before to-day (Friday) in two issues of Underground railway stock, namely, £2,356,000 of 4½ per cent. redeemable second debenture stock, 1942-72, in the London Electric Railway Co., and £3,769,000 4½ per cent. redeemable second debenture stock, 1942-72, in the City and South London Railway Co. Both issues are guaranteed as to principal and interest under the Trade Facilities Acts. The price of issue was £95 10s. per cent. The proceeds, as our readers are aware, are to be devoted to extension, reconstruction, and other works. It is understood that the scheme will give employment to between 20,000 and 25,000 men. We learn that the issues were promptly and heavily oversubscribed and the lists were closed on Tuesday morning.

Companies to be Struck off the Register.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Dawson Electrical Installations, Ltd.
Dome Battery & Accessories Co., Ltd.
G. M. Wireless Patents Syndicate, Ltd.
Hampstead Electrical Co., Ltd.
Holloway Electric Supply Co., Ltd.
London Armature Repair Co., Ltd.
Nazeing and District Electric Supply Co., Ltd.
North Bolivia Power & Estates, Ltd.
Owen Magnetic Transmission Syndicate, Ltd.
Provincial Wireless Colleges, Ltd.
Riviera Kearney High-Speed Railway Syndicate, Ltd.
South Coast Kearney High-Speed Railway, Ltd.
Tungsten Products, Ltd.
Turbines, Ltd.

North Melbourne Electric Tramways and Lighting Co., Ltd.—The report states that the sum realised on sale of undertaking and assets and cash-in-hand (after allowing for payments and expenses authorised by debenture holders) amounted to £118,820, which has been paid to debenture holders, making a total distribution of 71.15 per cent. of face value of debentures. The company has no other assets, and is not carrying on any business, and it is proposed that it be wound up voluntarily, and that Mr. H. W. Stacey be appointed liquidator for that purpose. The meeting is to be held at Cloak Lane, E.C., on November 7th.—*Financial Times.*

Erinoid, Ltd.—Net profit for 1923, £17,125. Dividend, 4 per cent., less tax; to reserve, £5,000. Carried forward, £7,480. The French company has completed the re-equipment of its factory, and is now supplying the French market.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

Calcutta Tramways Co.—688,050 ordinary shares of £1 each, fully paid, Nos. 1 to 688,050; and 250,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 250,000.

Buenos Ayres Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share, less tax, for three months ended September 30th.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend on the ordinary shares at the rate of 4 per cent. actual for the half-year ended June 30th.

STOCKS AND SHARES.

Tuesday Evening.

Rapid alternations of feeling and prices have occurred during the past few days in the temper of the Stock Exchange markets. First there was a sharp rise on the news that France had consented to be a party to inviting the United States to join in a conference on reparations. On top of this came the qualifying speech of the French President, which was regarded as something of a damper upon the high hopes that had been raised just before. The markets, however, refused to be discouraged by Monsieur Poincaré, and the Stock Exchange settlement for the middle of November has opened with conspicuous strength in some of the leading markets. There has been, for instance, recovery in the Metropolitans and Districts, with a fresh accession of inquiries for electric lighting shares.

The issue of £6,125,000 4½ per cent. debenture stock offered by the Tube Railways at 95½ is considered fairly expensive, though it was readily placed amongst investors attracted by the character of the security. The City & South London is responsible for £3,769,000 of the stock, and the London Electric Railway Co. for the balance of £2,356,000. The stocks are called second redeemable debentures, and are both dated 1942-72. They are guaranteed as to principal and interest by His Majesty's Government, and rank as part of the issue made a year ago at 95. A first payment of a full half-year's interest will be made on July 1st next year. The yield on the money is certainly not exciting, but nowadays the investor looks for security, and though he grumbles at being offered no more than 4¾ per cent., accepts this with readiness where the stock is above suspicion. Consequently, the subscription lists were quickly filled, and closed, well in advance of the full time, on Tuesday at noon.

The first effect of this issue was to lower the prices of some of the Tube stocks, but speculative investment came to the aid of Metropolitans and Districts, the prices of which have again risen and now stand at 79 and 56½, respectively. London Electric Railway shares are better at 7. The Underground group is irregular, with the £10 shares better at 3¼, although the Income bonds are a couple of points easier on the week ago.

Demand is very insistent for debentures and preference shares in the electricity supply group, notwithstanding the fact that people who take the long-distance view are disposed to argue that, if trade revives in the manner which Mr. McKenna and some of the other prophets rather suggest that it is likely to do, the effect will be to dislodge money from stocks and shares, and to divert it into industrial channels once more. This apprehension, if such it may be called, is vocal amongst gilt-edged stocks, but that it carries little weight is obvious from the fact that the War Loan and most of the best issues continue to gain ground. Charing Cross Electric 4½ debenture can be obtained at 94, giving a running yield of £4 16s. per cent., or £5 0s. 6d., taking into account redemption at 100 in 1941, or earlier, at 102. Urban Electric 5½ per cent. Mortgage debenture stock at 103½ pays £5 16s. 6d. per cent., with a shade less allowing for redemption. There is a partial interest payment due in December.

In the preference share list, one of the features is the strength of the new Lancashire Electric 7 per cent. cumulative and participating preference shares. These came out at 2s. and are now 6s. paid. They are offered at 2s. 3d. premium, giving just over 5½ per cent. on the money. They participate with the ordinary after the latter have received 7 per cent., and can receive up to 10 per cent. altogether. A few Westminster Electric 4½ preference can be obtained at 4½, at which the yield is, of course, 5 per cent. on the money, with dividends due in January and July. The new County of London Electric 6 per cent. preferences at 23s. 6d., return £5 3s. per cent. and South London Electric 6 per cent. first preference at 24s. 9d. afford £4 17s. per cent., with dividends in March and September. Of a more speculative type, Urban Electric 6 per cent. preference are on offer at 18s. xd., yielding £6 13s. 6d. per cent., and the same rate can be obtained from General Electric 7½ per cent. cumulative "B" preference at their current price of 22s. 6d.

In the cable group, Eastern Extensions, Eastern ordinary and Westerns are all lower, a certain amount of deceased account stock having come to market. Great Northerns are 5s. up and improvements occurred also in the Anglo-American stocks. Marconis are steady at 2 5/16, having barely budged for a fortnight, and Radio Corporation shares are better, the common at 13s. and the preferred at 16s.

Amongst cable manufacturing shares, Henleys and Callenders stand out with further rises that have taken the prices to the common level of 49s. 6d., at which the yield on the money is a trifle over 6 per cent. Siemens improved to 14s. 3d. bid; the preference came into demand at 22s. 6d. General Electric ordinary are better at £1. Preference stocks in this market are very firm. Callenders 7½ per cent. "B" preference have risen to 26s. 3d.

Mexican descriptions continue heavy, and the 6 per cent. bonds of the Mexico Tramways went back to 54½. Small declines in British Columbia preference and debenture are the only changes in their group. Brazilian Tractions gave way to 45, and Anglo-Argentines are steady, the second preference being 1/16 up. There is nothing fresh to report in the stocks and shares of the London transport share market. Brisbane Electric Investment ordinary are £1 lower at 3¼.

Babcock & Wilcox are hard at their improved price of 2 5/16. Vickers rose to 14s. The rubber market remains quiescent, attracting little attention, and the general tendency throughout the Stock Exchange seems to be set towards higher prices as capital continues to flow steadily into most of the markets, investment and speculative alike.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Oct. 30, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	2¾	—	£5 16 6
Charing Cross Ordinary	5	9	14	13	—	5 7 8
do. do. do. 4½ Pref.	5	4½	4½	4⅛	+ 1/16	5 4 4
Chelsea	1	6	10	38/-	—	5 5 3
City of London	1	14	15	2⅞	—	5 17 0
do. do. 6 % Pref. ...	1	6	6	21/-	—	5 4 4
County of London	1	8	10	2⅛	—	4 16 10
do. do. 6 % Pref. ...	1	6	6	23/8	—	5 3 3
Edmundson's Ordinary	3	Nil	7	4½	—	5 2 0
do. 6 % Pref	5	12/-	6	5	—	6 0 0
Kensington Ordinary	5	10	12	10½	—	5 18 5
London Electric	3	4	10	5	—	5 19 9
do. do. 6 % Pref. ...	5	6	6	5½	—	5 17 1
Metropolitan	1	7	8½	1⅞	—	4 17 2
do. 4½ % Pref.	1	4½	4½	17/6	+7d.	5 2 10
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	16/3	—	3 1 6
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	16/3	—	Nil
do. 5 % Pref. ...	1	2½	5	¾ xd	—	6 17 0
James' and Pall Mall ...	5	12	11½	11¼	—	6 2 1
South London	1	7	10	1⅛	—	5 3 3
South Metropolitan Pref. ...	1	7	7	21/6	—	5 14 3
Westminster Ordinary	5	10	12	10½	—	5 14 3
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	1	—	7 10 0

HOME RAILS.

Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	3½	39	+1	1 8 9
do. District	,,	1	3	56½	+ ½	5 6 2
Underground Electric Ordinary	10	Nil	Nil	3½	+ ⅛	Nil
do. do. "A" ...	1	Nil	Nil	10/-	—6d.	Nil
do. do. Income	Bonds	4	5	99	— 2	*5 1 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102 xd	+ ½	5 17 1
do. Def.	,,	1½	34/6	22½	+ ⅛	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17½	— ½	5 16 0
Eastern Tel. Ord.	Stock	10	10	173½	—2	5 15 3
Globe Tel. and T. Ord.	10	10	10	18	—	5 11 0
do. do. Pref. ...	10	6	6	11½	—	5 7 7
Great Northern Tel.	10	24	22	27½	+ ½	7 18 6
Indo-European	25	10	7	32½	—	*3 7 8
Marconi	1	25	15	2⅞	—	6 9 10
Oriental Telephone Ord. ...	1	12	12	1½	—	*6 8 9
United R. Plate Tel.	5	8	8	7	—	*5 14 4
West India and Panama ...	10	Nil	Nil	1/8	—	Nil
Western Telegraph	10	10	10	17½	— ½	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	2⅛	—	9 7 2
do. do. 2nd Pref.	5	Nil	5½	2⅜	+ 1/16	11 11 6
do. do. 5% Deb.	Stock	5	5	76½	—	6 10 9
British Electric Traction Ord.	,,	4½	5	74½	—	6 14 1
do. do. 6% Pref.	,,	6	6	101½	—	5 18 8
Brazil Tractions	100	Nil	4	45	—1	8 17 9
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	85½	—2	5 17 0
do. do. Preferred	,,	5	96/-	84½	—	*5 14 1
do. do. Deferred	,,	3	127/-	96½	—	*6 11 3
do. do. Deb. ...	,,	4½	4½	78½	—1	5 8 3
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	9/-	—	11 2 0
London United Tram. Deb. ...	Stock	4	4	60	—	6 13 4
Mexico Trams 5% Bonds ...	—	Nil	Nil	76½	—	6 10 9
do. 6% Bonds ...	—	Nil	Nil	54½	—1	Nil
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	62½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 6 0

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	15	20	2⅛	—	*4 6 9
British Aluminium Ord. ...	1	10	5	18/3	—	5 9 8
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	49/6	+9d.	6 1 2
do. 6½ Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	1	10	Nil	4/6	—3d.	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	1½	—	6 13 4
English Electric	1	8	5	17/9	+6d.	5 12 8
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 8
do. Ord.	1	10	5	1	+6d.	5 0 0
Henley	1	15	15	49/6	+1/6	6 1 2
do. 4½ Pref.	5	4½	4½	4¼	—	5 2 10
India-Rubber	1	10	—	10/6	—	—
Met.-Vickers Pref.	2	8	8	23	—	6 2 0
Siemens Ord.	1	10	10	14/3	+6d.	Nil
Telegraph Con.	12	20	20	25	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Oct. 31st.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	½d. dec.
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£35	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4d.	...
a Shellac ... ... per cwt.	£15	£1 dec.
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	15s. dec.
a ,, Roll ... ... ,,	£7 15s.	5/- dec.
a Soda, Chlorate ... ... per lb.	8d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	5/- to 10/- dec.
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £120	...
b ,, Wire ,, ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£193	£5 inc.
Grade II ... ... ,, ,,	£140	£7 inc.
Grade III... ... ... ,, ,,	£79	£5 inc.
c Brass (rolled metal 2" to 12" basis) ,, per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ... ,,	11¾d. to 1/0	...
c ,, Wire, basis ... ... ,,	10d.	...
c Copper Tubes (solid drawn) ... ,,	1/1d.	½d. dec.
c ,, Bars (best selected) ... per ton	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£63 10s.	30/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	30/- dec.
d ,, ,, Wire Rods ,,	£73 10s.	30/- dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	8/-	...
n German Silver Wire ... ... ,,	2/8	...
h Gutta-percha, fine ... ... ,,	6/6	...
h India-rubber, Para fine ... ... ,,	1/0½	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£31	£3 inc.
g Mercury ... ... per bot.	£9 10s. to £9 15s.	5/- inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/2	...
p ,, drawn bars and rods ,,	1/2½	½d. dec.
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ... ,,	1/3	½d. dec.
o Platinum ... ... per oz.	£25	...
d Silicium Bronze Wire ... ... per lb.	1/0½	½d. dec.
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£2 8 to £208 10s.	£4 to £4 5s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	8/-	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Manchester Electro-Harmonic Concert.—The opening concert of the Manchester Electro-Harmonic Society, held at the Albion Hotel, Manchester, last Friday evening, was highly successful. There was an attendance of about 150 members and friends under the presidency of Mr. S. L. Pearce, C.B.E. The programme included songs by Miss Olga Telga, and Mr. Bridge Peters, and 'cello solos by Mr. Ernest Thorley, all of which were highly appreciated, as was the entertainment provided by Ken. Mackay. During the evening Mr. W. J. Smith (hon. musical director) made a presentation to the retiring treasurer, Mr. Hall, and expressed the thanks of the Society for his efficient services. Mr. Hall, in reply, made a reassuring statement as to the progress towards recovery from the ailments which had necessitated his retirement. He assured the members of continued support to the Society, and looked forward to the time when his restoration to health would enable him again to take active work on its behalf. The presentation took the form of a gold fountain pen. Mr. Shaw moved a hearty vote of thanks to the President, and referred to the increased membership which had been attained. On behalf of the Society Mr. Shaw congratulated Mr. Pearce on his successful work in connection with the super-power station at Barton, and Mr. Pearce suitably responded and complimented the hon. musical director on the success of the evening's programme.

Another Diesel-Electric Ship.—Messrs. Cammell Laird and Co., Ltd., launched from their Birkenhead shipyard, on October 25th, the *La Maria*, the second of three Diesel electrically-equipped ships they are building for the United Fruit Co. A 14-knot vessel, 325 ft. long, she is a sister ship to the one described in our issue of October 26th.

THE ELECTRIFICATION OF THE SOUTH-EASTERN AND CHATHAM RAILWAY.

The South-Eastern and Chatham Construction & Power Co., Ltd., has recently placed an order with the Metropoiltan-Vickers Electrical Co., Ltd., for multiple-unit electrical train equipment required for the electrification of the South-Eastern suburban lines of the Southern Railway Co.

The rolling stock to be equipped will consist of 124 three-coach train units, and also 59 two-coach train units, and the electrical equipment ordered includes the current-collecting gear, main and auxiliary control apparatus, electrically-driven compressors and governors for the air brake system, the lighting and heating of the trains, and the complete wiring and connecting up. The motors themselves are being supplied under another contract.

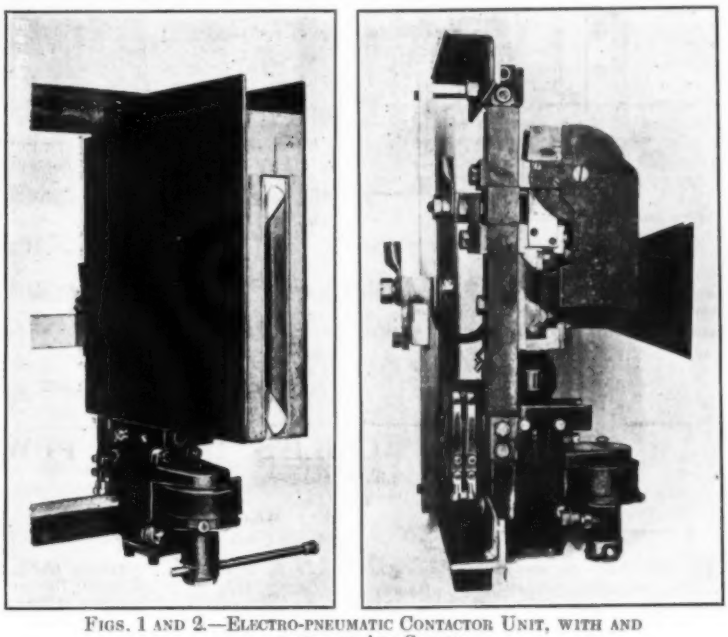
The control is of the automatic acceleration type, with which excellent results have been obtained on the L. and S.W. and Metropolitan Railways, both of which have been equipped by the Metropolitan-Vickers Co. With this system the driver has merely to move the handle of his small master controller right over, when each of the equipments along the train will automatically "notch up" under the control of their respective automatic current-limiting relays, and the train will be uniformly accelerated at the most economical rate without any further action on the part of the driver.

Master controllers are provided at each end of each of the three-coach train units, and these units are arranged for coupling up in a multiple unit, so that any combination of train units may be used. The additional two-coach trailer units are for the purpose of coupling between two three-coach units when required, so that a considerable variety of train combinations can be used to suit the traffic requirements.

The master controllers are provided with a "dead man's handle" of a similar type to that used on the L. and S.W. Railway. This handle is so arranged that should anything happen to the driver, whereby he abandons the conscious effort of holding the control handle, the current will be automatically cut off, and the brakes applied.

The company manufactures two types of control apparatus for suburban electric service; one is the "all-electric" system, good examples of which are in service on the L. & S.W. Railway, Metropolitan Railways, and the Buenos Aires Railway; and the other type is the electro-pneumatic system used by the Metropolitan, Mersey, and North-Eastern Railways in this country, and now being adopted in the electrification of the South African Railways, as well as for other systems in Australia, Holland and Japan, and it is this type of control that has been selected by the electrical engineer of the S.E. and C. Construction & Power Co.

The control of the main motors is effected by a number of individual contactor switches, grouped together in a convenient form. These switches serve for making the necessary series-parallel motor combinations, and for cutting out the main resistances during acceleration. The contactors are operated by compressed air cylinders through the medium of small electrically-controlled valves, the latter being excited at low voltage through train lines connected to the master controller in the driver's cab. The contacts are closed by the compressed air cylinders against the action of a strong spring, so that when the air is released a smart and decisive break is obtained, while the contact pressure between the switch jaws is very high when the switch is closed. Figs. 1 and 2 show the construction of this unit switch, and from these it will be seen that the switch frame consists of two vertical insulated bars, to which are clamped the main switch contacts with their blow-out system, and the operating cylinder underneath. The piston rod of the operating cylinder is insulated from the switch contacts by means of an egg-shaped insulator of special material, which is tested up to very high stresses, both mechanically and electrically.



Figs. 1 and 2.—Electro-pneumatic Contactor Unit, with and without Arc Shield.

One of the features of this type of unit contactor switch is that it occupies a relatively small space, so that the complete group of switches with the reverser, and also the accelerating relay, overload relay, and auxiliary switches can be conveniently assembled in one switch group of relatively small dimensions, as shown in fig. 3, from which it will be seen that the contactor switches and the reverser are all mounted inside the switch group case. The overload and limit switches, &c., are conveniently mounted in small separate cases on the ends of the switch group (see fig. 4).

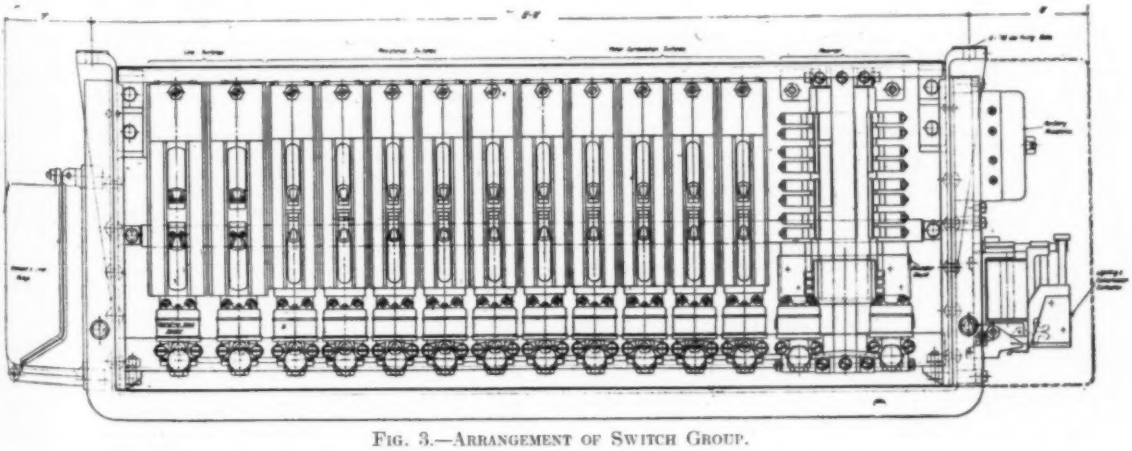


Fig. 3.—Arrangement of Switch Group.

The contactors and reverser are mounted on two horizontal angle irons, to which they are attached by a single bolt at the top and bottom. This makes the removal and replacement of

individual units extremely easy. The switches themselves consist of parts of identical construction easy to assemble so that the number of parts to be carried in stock for maintenance is a minimum.

The motors and circuits are protected against overload by means of an adjustable overload current relay (fig. 5), which can be set to trip at the desired current. When this relay acts on overload it opens the control circuits, and all the contactor switches then open, thus cutting off power from the motors. The relay then remains open, and can be reset by means of a reset contact on the control switch, but only when the master controller is in the "off" position. Fig. 6 illustrates one of the accelerating relays.

The heating of the trains will be done electrically by means of the usual type of railway coach electric heater, and the heaters will be grouped in suitable circuits.

Collection of current will be from an over-running type of third rail by means of shoe gear, very similar to that in use on the L. & S.W. Railway, and the same type of protective fuses will be used.

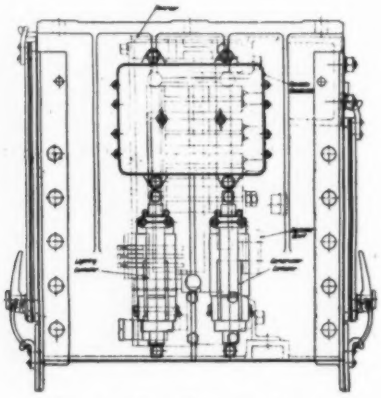


Fig. 4.—End View of Group.

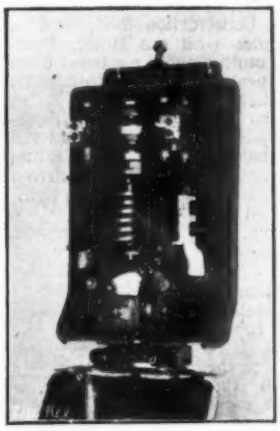


Fig. 5.—Overload Relay.

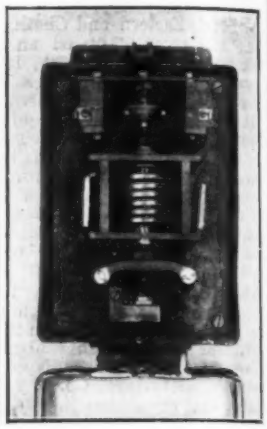


Fig. 6.—Accelerating Relay.

CHILE'S BUYING POWER.

GRADUAL REVIVAL.

An excellent idea of the great variety of Chile's natural resources and the noteworthy progress that is being made in her manufacturing industries is to be gained from the report* by H.M. Consul-General at Valparaiso (Mr. J. M. Macleod), which has recently been issued by the Department of Overseas Trade.

Nitrate, copper, coal, iron, manganese, gold, silver, lead, mercury, graphite and sulphur are amongst her mineral resources. Nitrate is the principal, and as producer of copper Chile already holds the second place. When the developments at the Chuquicamata, Braden, and Potrerrilos properties are in full operation, she will be the leading copper producer in the world.

The chief deposits of high grade iron ore are in Coquimbo and Atacama. The ore is about 67 per cent., and is both hematite and magnetic, and very low in phosphorus. The only deposits which are being actually worked are those at Tojo, whence last year about 300,000 tons of ore were shipped. The Government is keen on inducing owners of deposits to establish an iron and steel industry in Chile and offers special privileges. The Consul-General points out that the two main difficulties are (1) Chilean coal is unsuitable for making the necessary coke; (2) the local market is too limited.

The principal coal mines are in the provinces of Concepcion and Arauco. There is a movement on foot to tax imported coal, but the Government is reluctant to do this because it is not certain that the local companies will be able to assure a sufficient normal production. The Consul-General states that if labour-saving devices be increasingly adopted, the Chilean coalfields will for many years be able to do much more than hitherto towards taking care of the coal requirements of the country. Meanwhile the increased use of fuel oil and the electrification of various railways are tending to reduce the consumption of coal. Imports are now under 500,000 tons annually, whereas in 1911 they were 1,300,000 tons.

In addition to its mineral wealth, Chile is rich in agricultural produce, which finds a ready market in the nitrate districts. In her southern provinces there are over 60,000 square miles of forests, bearing all classes of timber suitable for building, furniture, and pulp.

Goods in Demand.

The recent revival in the nitrate industry, together with the increased activity in copper production, is bringing about a marked recovery in the purchasing power of the community which will soon be clearly reflected in an advance in imports. Mr. Macleod says that owing to greatly reduced importation last year, and in part of 1922, local markets have been denuded of stocks, so that a quickened demand for constructional material, cement, iron, steel, &c., and for all kinds of machinery for the nitrate and agricultural industries, may be anticipated.

The steady development of manufacturing industries in Chile renders that country a fairly attractive field for the electrical exporter. Cement production has a good future; wire nails, aluminium ware, bedsteads and glassware are being turned out satisfactorily; there are various foundries and engineering repair shops in different parts of the country; and amongst other articles made are leather goods, footwear, tobacco, furniture, beer, mineral waters, biscuits, and preserves.

The Consul-General recommends that in entering this market an active local agent be appointed, who understands thoroughly the particular line which it is desired to introduce, and an agent, moreover, who is able and willing to devote adequate time to the work. In many instances, when the services of an agent have been dispensed with and sales made direct, heavy losses have resulted. It is generally desirable, before agents are appointed, to send out a special representative to study the conditions on the spot. The representative must speak Spanish, and must be a person of education and of the standing to be *persona grata* in Chilean society generally. Information as to business capacity, integrity, &c., of local firms can generally be obtained from His Majesty's Consul-General, or other salaried members of the Consular service, or from the leading Chilean banks.

In analysing the shares of the chief countries participating in Chile's import trade, the Consul-General finds that Germany has apparently recovered about a fourth of her pre-war trade. France has fully recovered hers, and Great Britain seems to have returned to her pre-war volume. Spain has not held the advantage she gained during the war, but Belgium is likely to show a considerable advance by reason of special imports of tramway rails and tramway cars for Valparaiso.

Railway Electrification.

The report refers to the progress that has been made in the electrification of the Valparaiso and Santiago railway, the contract for which was given to an American company. Sufficient material was installed for the inauguration of a section of the electrified line (Santiago Til-til) to take place during the holding of the Pan-American Congress at Santiago in April, 1923. The line to be electrified consists of 116 miles between Valparaiso and Santiago, and 28 miles from Las Vegas to Los Andes. The motive power will be obtained from the River Colorado, the generating station having three Westinghouse generators. Amongst the material purchased for this electrification are six locomotives for ex-

* H.M. Stationery Office or D.O.T. Price 2s.

gress passenger trains, 11 for local passenger trains, 15 for goods trains, and seven for different services—a total of 39 locomotives purchased from the Baldwin Co. (U.S.A.), and the Westinghouse Electric International Co. (U.S.A.).

As a result of the heavy expenditure incurred in acquiring this and other railway material abroad, there has been a great outcry from certain sections urging the Government to have as much material as possible constructed in the country. Examples are cited of passenger cars for second-class passengers which, imported, cost $200,000, whilst one, constructed in the country, cost $50,000. Recently the railway workshops turned out six locomotives; every part of each, with the exception of the wheels, was constructed by Chilean labour and with local material. These locomotives are understood to be equally as good as the American article, the cost being $90,000, Chilean currency, each, as against $500,000.

The northern longitudinal section, which taps the country between Pueblo Hundido and Caelra, has not been able, owing to lack of sufficient rolling stock, together with high freights, to render that service which is indispensable for the progress of the important agricultural and mining districts through which it passes. However, the Baldwin Co. (U.S.A.) has just delivered 10 new "Mikado" locomotives, and a number of goods and passenger cars, and it is stated that in future there will be no room for complaint of delay in the transit of cargo. These locomotives, which, with tender complete, weigh 104 tons each, are designed to haul trains of 90 tons. The longitudinal railway is useful for tapping the interior districts to enable the produce and minerals to be brought down to the nearest port, but it will always be infinitely cheaper to ship to the northern nitrate ports by sea than by rail. A bag of beans weighing 100 kilos sent by rail from Valparaiso to Antofagasta would cost $11.00 and by sea $3.00.

The Consul-General adds that a very considerable amount of railway construction is now being carried out and a great deal more is contemplated both by the State and by private enterprise. A power station is under construction at Los Maitenes, on the Rio Colorado (Red River) affluent of Rio Maipo near Santiago. This hydro-electric station will have three water supply pipes, each to deliver 5,500 litres per second, and capable of yielding 10,000 h.p. Electricity will be generated at 6,600 volts, 50 cycles, and stepped up to 110,000 volts for transmission to the Valparaiso tramways, Santiago tramways, State Railways, and the Melon cement factory.

In a supplementary report, the Acting British Vice-Consul at Valdivia, states that efforts are being made to raise five million currency to buy the electric light company of Messrs. Ehrenfeld Hnos, and to establish a tramway service. The initial steps were taken some months ago, and it was given out that the service would be initiated in September of the present year. No progress, however, is being made as far as can be seen, and the project received a setback a short time ago owing to the death of the engineer who was responsible for it. There is a decided feeling that this scheme will not be realised promptly.

THE POSTMASTER-GENERAL AND ELECTRICAL POWER AND LIGHTING INSTALLATIONS: A RETORT.

By S. C. BARTHOLOMEW.

I must confess to a feeling of surprise after reading Mr. Stoker's rejoinder and the editorial comment in the issue of October 19th. It has been a shock to find that one can be so misunderstood.

Let me first of all deal with Mr. Stoker's rejoinder—and I shall have to quote:—

"Indeed, his reference to the 'necessity for securing the safety of the public' seems to suggest that the Postmaster-General does in point of fact conceive a rather wider scope for his activities than is imposed on him. Responsibility for the safety of the public is not with the Postmaster-General but with the Electricity Commissioners, who may be safely entrusted with it."

I have not stated, nor can it be reasonably implied from my article that the Postmaster-General is responsible for securing the "safety of the public." I have re-read my contribution and can find no such interpretation in the paragraphs where I gave what I consider a fuller explanation of the law and regulations regarding earthing, than that in Mr. Stoker's first article.

Although Mr. Stoker says that I only called attention to one inaccuracy on the legal side (that was a reference to the amendment to Section 26 of the Electric Lighting Act, 1882) should be not admit another in the matter of the serving of regulations prescribed under Section 4 of the Electric Lighting Act, 1888, upon statutory undertakers, *i.e.*, those working under the provision of a licence, order or special Act? I asked: What are the circumstances in which these regulations would be served upon a statutory undertaker by the Electricity Commissioners? and suggested that it would not be worth while for statutory undertakers to examine and consider the conditions under which they are working in this respect. Mr. Stoker's reply does not elucidate this point, and I cannot find any basis for the assumption that those particular regulations can be served upon a *statutory* undertaker.

Here may I express regret for the omission of the word "clauses" in my reference to the Electric Lighting (Clauses) Act, 1899, and the misquotation of "would" for "should"? Owing to absence from London, the proof of the article did not reach me in time for correction. On the other hand, may I point out that, from goodness of heart, I corrected in my article, without remark, Mr. Stoker's incorrect reference to an article as appearing in the Electrical Review on May 25th, when it really appeared in the issue of May 18th.

I have a very clear idea of the functions of the Electricity Commissioners and of the Postmaster-General, and I do not think there is evidence of confusion in my article. On the other hand, I am accused of mis-reading the import of Mr. Stoker's article. Surely the expression "The Postmaster-General cannot arbitrarily or capriciously withhold his concurrence," following on "especial difficulties have arisen lately owing to the attitude of the Postmaster-General," and "it would appear that the Postmaster-General has recently been seeking to assume sole and original jurisdiction, &c.," could only be taken to mean that the Postmaster-General had acted "arbitrarily" and "capriciously," and I in turn ask those interested to refer to the original article in the issue of September 28th.

The further technical references by Mr. Stoker are very easily disposed of. First of all, I should like to point out that Sir Philip Dawson's book, "Electric Traction on Railways," was not published in 1905, as stated, but in 1909. I do not know whether this affects the calculation of ten years' interval between the publication of that book and of Mr. Austin's book. I can dispose of the question whether or not the Board of Trade approved of a drop of 20 volts on the rails by quoting Sir Philip Dawson himself. I find that in the discussion on Philip Dawson's paper "The Electrification of a Portion of the Suburban System of the L.B. and S.C. Railway," read before the Institution of Civil Engineers on March 14th, 1911, Professor Jenkin questioned the fixing of a voltage drop by the Board of Trade, and this was the reply by Sir Philip Dawson:—

"It was therefore not correct to say that the Board of Trade had adopted a limit of 20 volts as a condition or regulation."

This confirms my recollection of a conversation on the subject with Mr. Trotter, who was at that time the Board of Trade's electrical adviser.

At the conclusion of my previous contribution I complained that Mr. Stoker's article had been written "without inquiry as to the true position." His further reference now to the 1893 Report of the Joint Committee of the House of Lords and House of Commons confirms my opinion. No. 3 of the Committee's resolutions recommended the use of insulated return conductors for telephones, and Mr. Stoker makes the comment: "Recommendation 3 appears to suggest a proper means of meeting abnormal happenings such as are referred to by Mr. Bartholomew." Surely someone should have informed Mr. Stoker that single-wire telephone circuits for public service have been discontinued for many years. I think it can be taken, too, that the Joint Committee's recommendation on this point was based largely on evidence given by the late Sir William Preece, who was at that time engineer-in-chief to the Post Office, and who in evidence before the Committee recommended the use of double-wire circuits for telephones, as used by the Post Office, instead of the single-wire telephone circuit generally used by the telephone companies at that time.

I cannot help feeling that Mr. Stoker has not been well advised on the technical side.

Turning now to the editorial comments, I must first of all express my gratification that my article was considered worthy of being so honoured, even though it is criticised vigorously. I hope to show that the criticism has no surer grounds than Mr. Stoker's.

It is, first of all, stated that I referred to the Electricity Commissioners' Regulations as though they were like the "law of the Medes and Persians," and that "those regulations, however, are not only capable of alteration, but are actually in course of revision, &c." Can it be wondered that I am astonished at such comments when I am actually a member of the committee of the Institution of Electrical Engineers

which is engaged in revising those very regulations for submission to the Commissioners? Does not Section 6 of the Electric Lighting Act, 1882, say that they can be amended from time to time, and was I not well aware of that? It would seem, therefore, either my pen sadly misrepresented me or, conversely, that what I wrote has been misunderstood.

Next, I agree absolutely that there can be no shadow of doubt as to the power of the Electricity Commissioners to authorise the connection of a circuit with earth in as many places as they please *if such are required for securing the safety of the public*. If, however, the earthing is not required for securing the safety of the public, then the Postmaster-General's concurrence is necessary according to law. It is asked: "What right has the Postmaster-General to withhold his concurrence?" Mr. Stoker supplies the answer. "It can scarcely be too strongly emphasised that the powers of the Postmaster-General are given to him for the sole purpose of ensuring protection of his lines from injury."

If the Postmaster-General withholds his concurrence it would be on the grounds given by Mr. Stoker, based on sound technical considerations. This, of course, is the definite issue between us, and I say confidently that the use of a high or extra-high-pressure cable, using one insulated conductor only and an earth return, would be likely to cause interference with both telegraph and telephone circuits in its immediate neighbourhood. In passing, I know of no statutory undertaker having put forward such a proposal.

I now join issue on your technical arguments on the use of an earth-return high-pressure electric light main.

Electrolytic action cannot be ruled out altogether. The following is from a recently-published book by W. R. Cooper, M.A., B.Sc., on "Electro-Chemistry Related to Engineering," in the chapter on electrolytic corrosion by earth currents, in the part dealing with alternating-current electrolysis:—

"It follows from this investigation that with a low-pressure the resulting corrosion may be inappreciable. With high pressure, electrolysis will certainly take place, and the higher the pressure the less will be the effect of polarisation."

I must apologise for making so many quotations, but I really must give another in connection with the statement that "a reasonably steady flow of alternating current through the earth would have no effect on telegraphs." This is what Mr. Ferranti said at a dinner in 1911. He was at the time president of the Institution of Electrical Engineers:—

"Well, one day we had not sufficient machinery in London and therefore had to run from Deptford Station, and one of those cables failed—even at the reduced pressure—about four o'clock. It was getting dark; fortunately it was not the worst time of the year, but in another hour and a half or so the lights would have to be shut down in the West End. I do not know what name you would give it, but I determined to take the earth into my service; and, as we had very good earth connections in London, and good earth connections at Deptford—about seven miles apart, I think the points were—I determined that we would run our supply that night upon a single conductor, bringing the current back through the earth. Well, it is almost forgotten now what happened, but I need hardly tell you that telegraphic communication with the Continent was stopped. The papers said it was an electrical storm which had stopped all communication between ourselves and the Continent as far as Rome. How far this was exactly true I do not know, but I know that when we came to talk about the cause I knew what had happened—and the principal engineer of the Post Office knew. I was very penitent, but said it was the result of necessity and would not occur again, I think the public got no further on that occasion than an electrical storm as a detriment to public service."

Some allowance must, of course, be made, as it was an after-dinner speech, but many old-timers remember the occurrence well, and can corroborate the facts.

As regards interference with telephones, I should have thought that the specific instance given in my article would, at least, have prevented the matter being so lightly dismissed thus:—

"A pure sine wave of 50 cycles frequency would not interfere with telephone conversation, even in the unlikely event of induction taking place."

The point here is, of course, the pure sine wave, but in passing I should perhaps say that a part of the disturbances produced in the specific case mentioned in my previous communication consisted of telephone relays rattling at a frequency of 40 per second, the fundamental frequency of the power system. As regards the pure sine wave, I was aware of the paper read recently by Professor E. W. Marchant and T. H. Turney before the British Association, which described a method of improving the wave-shape on three-phase systems; but I am doubtful whether those proposing to use the earth return system were aware of this when they were advocating their scheme! It is surely something of an answer to most of your criticism of the Post Office attitude that, as you say, in the discussion Professor G. W. O. Howe drew attention to the importance of this method in connection with the question of interference with telephones. I am, of course, hoping that the method will be successful, but it has not been tried so far on a large scale, and in any case apparently not with single-phase systems, although, at the moment, I can see no objection to its use on such systems.

Anyone who has kept in touch with the extension of single-phase railway electrification knows that one of its great drawbacks is the difficulty it causes in working telegraph and telephone circuits in the vicinity. I was surprised, therefore, to see the editorial comment. Chapter and verse can be given of disturbances in all countries where it has been introduced.

It is, of course, very tiresome that I should have to disagree with so many of the points made with such emphasis. It is not the practice of the Post Office to publish all the interesting occurrences which happen in its many fields of activity. The reply, therefore, to the editorial question following a reference to accidental earths on power systems: "Is it alleged that this dislocated the telegraph and telephone service?" may not be what was anticipated. The occurrence of accidental earths has in many cases dislocated telegraph and telephone services over very wide areas. In one instance inductive effects were such as to actually set on fire a test hut. I am not referring here to effects of burn-outs, which actually cause physical damage to telegraph plant, but to interference effects set up by abnormal conditions on a power system.

The multiple earthing on the North-East coast is an arrangement not on all fours with the proposal now being discussed, and in the other cases there are certain restrictive conditions governing the use of the earth. But these arrangements and the technical aspect of interference are not suitable for discussion in articles of this character, and I am hoping that shortly the matters will be presented fully in another place, where generalities will not suffice as criticism, and where, perhaps, the atmosphere will not be so provocative.

I hope I have shown that the editorial conclusion: "The Post Office in fact has no case against the use of the earth on technical grounds" is unsound, but I am at one with any effort to encourage the supply of cheap power and lighting to farmers. I wish that I could obtain electric lighting, even in London. The nearest consumer is 150 yards from my house and there is a continuous row of houses between of prospective consumers, yet the company serving the locality has made no effort to extend the system in my direction for years, nor has it to my knowledge made inquiries as to the number of possible customers.

May I say, finally, that it would be greatly in the interests of the Post Office if all districts were served by underground mains, as in that case guarding difficulties would disappear, and we would welcome any sound underground system of distribution which could replace overhead electric light and power lines.

P.S.—The comment by "C. M. G." in your issue of October 26th on the direct connection of a high-pressure meter to an extra-high-pressure system is simply explained. The supply is generated at e.h.p. and is stepped down in an outlying district by an auto-transformer to high pressure. The earthed outer of the system is, therefore, common to both the high and e.h.p. parts of the circuit. The failure of the high-pressure meter naturally affected the whole of the circuit, high and e.h.p. I do not understand the reference to "second-hand" information. Information of this character would, of course, be obtained second-hand, as it was not a Post Office system, but as power engineers are usually truthful, I have no reason to doubt the facts.

Rhine-Main-Danube Canal.—How, in spite of her pretended poverty, Germany is spending much money on the development of her commercial resources is indicated in a recent article in the *Daily Mail*, which describes the work that is being done in connection with the ambitious Rhine-Main-Danube Canal scheme. The canal was planned before the war to facilitate German trade in the Balkans and Near East, Herr Hugo Stinnes being the moving spirit in the enterprise. The Rhine, Main, and Donau Aktien Gesellschaft, a joint-stock company, has as its principal shareholders, not only the German Reich, but different States, such as Bavaria, Baden, Würtemberg, &c., and various loans have been floated under the guarantees of the Government. The canalisation of the Neckar river is proceeding actively, and a large electricity generating station is in course of erection, electricity being a commanding feature of the whole scheme. A number of falls are being harnessed at different points, with a conduit above the main river, to drive the water turbines.

This Week's Story.—A correspondent writes:—"An Ex-R.E. Signals was in my place one day last week, and on the subject of conductance of wire stated that on one occasion, instead of cutting a few yards of telegraph cable, he joined up to the ends of a drum of wire, when up came the "Brass Hat" with his S.M. and said: "Sergeant-Major, what is this?" The S.M. asked the Sergeant, the Sergeant asked the Corporal, the Corporal asked the Signaller, who stated that he did not desire to cut the wire and have short ends about. "Ha!" said "Brass Hat," "I have discovered why the messages are delayed; two miles of wire on that drum, and they has to travel all that distance. Yes. No wonder! Consider yourself a prisoner."

CANADIAN IMPORTS AND EXPORTS.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ending March 31st, 1923, are taken from the recently-issued trade statistics. Figures for the year 1921-22 are given for purposes of comparison, and notes of any increases or decreases have been added:—

Imports.

	1921-22 $	1922-23 $	Inc. or dec. $
Copper wire, plain, tinned, or plated.—			
Total	21,000	31,000	+ 10,000
From United Kingdom ...	2,000	2,500	+ 500
„ United States ...	19,000	28,000	+ 9,000
Copper wire, covered, including cable.—			
Total	197,000	277,000	+ 80,000
From United Kingdom ...	16,000	21,000	+ 5,000
„ United States ...	181,000	253,000	+ 72,000
Electric batteries, primary.—			
Total (mainly from U.S.A.)	44,000	38,000	− 6,000
Electric batteries, storage.—			
Total	803,000	687,000	− 116,000
From United Kingdom ...	—	134,000	+ 134,000
„ United States ...	802,000	553,000	− 249,000
Electric fans.—			
Total	*	123,000	—
From United Kingdom ...	*	2,000	—
„ United States ...	*	120,000	—
Electric fuses, fuse plugs, and cut-outs.—			
Total	*	156,000	—
From United Kingdom ...	*	1,000	—
„ United States ...	*	153,000	—
Lightning arresters, choke coils, &c.—			
Total (mainly from U.S.A.)	*	139,000	—
Rheostats, controllers, &c.—			
Total (mainly from U.S.A.)	*	228,000	—
Sockets, outlets, and receptacles.—			
Total	*	131,000	—
From United States ...	*	123,000	—
„ Japan	*	8,000	—
Spark plugs, magnetos, and other ignition apparatus.—			
Total	*	136,000	—
From United States ...	*	130,000	—
„ United Kingdom ...	*	6,000	—
Electric cooking and heating apparatus.—			
Total	83,000	112,000	+ 29,000
From United Kingdom ...	1,000	1,000	—
„ United States ...	82,000	110,000	+ 28,000
Dynamos and generators.—			
Total	1,357,000	1,317,000	− 40,000
From United Kingdom ...	38,000	21,000	− 17,000
„ United States ...	1,313,000	1,272,000	− 41,000
Electric light fixtures.—			
Total	409,000	448,000	+ 39,000
From United Kingdom ...	8,000	9,000	+ 1,000
„ United States ...	386,000	415,000	+ 29,000
Electric meters.—			
Total	239,000	227,000	− 12,000
From United Kingdom ...	66,000	53,000	− 13,000
„ United States ...	172,000	174,000	+ 2,000
Arc lamps.—			
Total (mainly from U.S.A.)	24,000	33,000	+ 9,000
Incandescent lamps.—			
Total	576,000	758,000	+ 182,000
From United Kingdom ...	30,000	41,000	+ 11,000
„ United States ...	173,000	131,000	− 42,000
„ Japan	36,000	93,000	+ 57,000
„ Holland	241,000	306,000	+ 65,000
„ Belgium	80,000	99,000	+ 19,000
Electric motors.—			
Total	1,753,000	1,582,000	− 171,000
From United Kingdom ...	219,000	94,000	− 125,000
„ United States ...	1,530,000	1,480,000	− 50,000
Self-contained lighting sets.—			
Total (mainly from U.S.A.)	143,000	76,000	− 67,000
Sockets.—			
Total (mainly from U.S.A.)	80,000	*	—
Telegraph instruments.—			
Total	137,000	979,000	+ 842,000
From United Kingdom ...	78,000	90,000	+ 12,000
„ United States ...	59,000	785,000	+ 726,000
Telephone instruments.—			
Total	585,000	797,000	+ 212,000
From United Kingdom ...	3,000	347,000	+ 344,000
„ United States ...	579,000	450,000	− 129,000
Switches, switchboards, circuit breakers and parts.—			
Total	*	734,000	—
From United Kingdom ...	*	19,000	—
„ United States ...	*	711,000	—
Transformers.—			
Total	227,000	152,000	− 75,000
From United Kingdom ...	4,000	2,000	− 2,000
„ United States ...	223,000	150,000	− 73,000
Electrical apparatus, n.o.e.—			
Total	4,438,000	2,997,000	−1,441,000
From United Kingdom ...	111,000	143,000	+ 32,000
„ United States ...	4,310,000	2,847,000	+1,463,000
Steam engines.—			
Total	213,000	318,000	+ 105,000
From United States ...	184,000	253,000	+ 69,000
„ United Kingdom ...	29,000	65,000	+ 36,000

Exports.

	1921-22 $	1922-23 $	Inc. or dec. $
Batteries, telegraph and telephone apparatus.—			
Total	39,000	273,000	+ 234,000
To United Kingdom ...	4,500	11,000	+ 6,500
„ United States	14,000	8,000	− 6,000
„ Newfoundland	8,000	10,000	+ 2,000
Dynamos, generators, and motors.—			
Total	56,000	43,000	− 13,000
„ United Kingdom ...	1,000	1,000	—
„ United States	17,000	26,000	+ 9,000
„ New Zealand	12,000	3,000	− 9,000
Electric cooking and heating devices.—			
Total	28,000	42,000	+ 14,000
To United Kingdom ...	2,000	1,000	− 1,000
„ New Zealand	6,000	16,000	+ 10,000
„ Australia	12,000	20,000	+ 8,000
„ Newfoundland	1,000	—	− 1,000
Spark plugs, magnetos, and other ignition apparatus.—			
Total	*	216,000	—
To United Kingdom ...	*	116,000	—
„ Australia	*	36,000	—
„ New Zealand	*	13,000	—
Electric apparatus, n.o.e.—			
Total	362,000	625,000	+ 263,000
To United Kingdom ...	145,000	336,000	+ 191,000
„ Australia	15,000	29,000	+ 14,000
„ New Zealand	54,000	63,000	+ 9,000
„ Newfoundland	11,000	8,000	− 3,000
„ United States	66,000	38,000	− 28,000
Copper wire and cable, insulated.—			
Total	440,000	291,000	− 149,000
To United Kingdom ...	5,000	12,000	+ 7,000
„ United States	105,000	41,000	− 64,000
„ Brazil	152,000	31,000	− 121,000
„ British S. Africa	122,000	105,000	− 17,000
„ Newfoundland	7,000	8,000	+ 1,000
„ New Zealand	2,000	58,000	+ 56,000

*Not shown separately.

S.s. "Maloja."—The large twin-screw P. & O. passenger vessel *Maloja*, a new liner of 20,800 gross tons, left port for London recently, after undergoing very successful trials in Belfast Lough. Accommodation has been provided for 327 1st and 329 2nd class passengers, and the electrical installation is of an elaborate character. There are six main generators, having a combined capacity of 900 kW, and in addition one 75-kW emergency dynamo situated well above the water-line, from which light and power can be supplied if for any reason the main sets are out of commission.

The number of bells fitted in the vessel is approximately 1,000, and these, in addition to the efficient system of inter-communication telephones, add greatly to the convenience of both passengers and crew.

The lighting installation is a very large one, consisting of almost 3,000 lights. Electric heaters have also been installed throughout the cabin accommodation, which can be regulated at will by the passengers. Fans have been provided in each cabin, in addition to those in the public rooms and machinery spaces, the diameter of the former being 16 in., and that of the latter ranging from 12½ to 60 in.

Among the electrical appliances of special note are: A 20-in. searchlight of the Parsons split mirror type; a Willett-Bruce whistle control, and a wireless telegraph set which enables passengers both to transmit and receive messages. The condenser air and circulating pumps are electrically driven.

HACKNEY ELECTRICITY WORKS EXTENSION.

On Thursday afternoon last week, with the local pomp and circumstance usual on such occasions, the opening ceremony of the Hackney electricity works extension took place. The Mayor (Councillor Genese), addressed a large audience in a marquee, those present consisting of councillors and officials, ratepayers and/or their wives, daughters and sweethearts, with many babes in arms, and, incidentally, as it seemed, some of the leading men in the electrical profession and industry. The speaker said many things which were for the electrical education of the public, who will, no doubt, in consequence become consumers of "Hacktricity" as a means for engendering "domestic felicity. It he simultaneously contributed to the delectation of his technical listeners that only added to the gaiety of the occasion and helped to complete its purpose. This very mixed assembly subsequently lined up, the mighty host advancing as the Mayor led on, in processional form, for a tour around the works, including the destructor, where local odours were not inconspicuous. When the generating station was reached the new 10,000-kW turbo-generator set, which was described in our last issue, was named "Genese," after the Mayor, by Alderman Mrs. S. Hammer, wife of the chairman of the Electricity Committee, and the Mayor then ran the machine up to full speed. Subsequently the large company returned to the marquee for tea and such-like social amenities. The event was well organised from the local electricity propaganda standpoint, and Chief L. L. Robinson, who "cannot be curbed" by anybody at Hackney, seemed all the while in his element though, even with a megaphone, he could not make himself heard above the music of machines which, unperturbed by what was passing around them, were serving the factories of Hackney with power. But, in the words of the song, "What you couldn't see (or hear) you could very easily guess!" Were we in reminiscent mood we might recall the early days when we listened to councillors as they blocked each other's motions until past midnight five and twenty years ago, when the vital questions were whether Hackney should own its electricity undertaking and whether Robert Hammond or somebody else should be its consulting engineer, and when councillors wanted to know what the late respected Robert would do with 5 per cent. on £250,000 if he were appointed, also the interesting proceedings on the occasion of the laying of the foundation stone and the subsequent actual opening of the station, when we were told so emphatically that not one pound of the refuse would be handled by human agency—but we refrain, for since then Hackney has become aristocratic by the more frequent sounding of the borough aspirate, and though it does not remember it always now where personal names are concerned, what matters that, seeing that it is to-day one of the most enterprising and pushful electrical boroughs in London?

Dinner.

In the evening a dinner was given by the Corporation at the Holborn Restaurant, the Mayor (Councillor John Genese, J.P.) presiding. There were over 300 guests, including members of the Hackney Borough Council, Sir Charles Parsons, Dr. S. Z. de Ferranti, Sir James Kemnal, Mr. G. Spencer Hawes, Sir Alex. Kennedy, Mr. John May, Mr. Alfred Holmes, Mr. C. H. Wordingham, Mr. J. W. Beauchamp, Mr. A. C. Cramb, Mr. G. W. Humphreys, and many other well-known engineers.

After the loyal toast had been honoured, Sir Charles Parsons proposed "The Hackney Electricity Undertaking," remarking that the Council was determined that Hackney should march forward with the great wave of things electrical that was taking place all over the world. Recalling the introduction of his steam turbine 34 years ago, Sir Charles pointed out the vast progress that had been made; turbo-generators of 50,000 kW were being installed in American stations, but very little gain in economy of fuel resulted from the use of such large sets. The most important factor in cheapening electricity was diversity of load, and one of the best means of increasing the diversity was the development of the domestic load for power, heating, and lighting. The Hackney undertaking stood first in its group in the report of the Electricity Commissioners on fuel economy, and its thermal efficiency was very close to that of the most economically situated generating station in the country.

Councillor W. Hammer, Chairman of the Electricity Committee, responded, asserting that Hackney was even now only at the beginning of great possibilities. Of the borough electrical engineer and his deputy it was impossible to speak too highly. With the inauguration of the new set Hackney moved into Class G of the Schedule, so that many members of the staff would receive higher salaries.

Dr. S. Z. de Ferranti, proposing "The Housewives of Hackney," said they had been responsible for helping on the development of electricity supply. They should educate the people with regard to the advantages of electricity, which would win every time, because it was better than its rivals. If the rest of the undertakings of the country were run with the same enthusiasm as Hackney's, the domestic load would be doubled—and that meant a very big thing. Its success was due to the ability of Mr. L. L. Robinson and to his full support by the Electricity Committee. Mrs. Alderman Hammer responded, expressing the indebtedness of housewives to the men of the electrical industry for harnessing electricity to domestic uses, cutting out half their work and leaving them with plenty of leisure.

Mr. L. L. Robinson proposed "Supporters of Hackney Electricity," referring first to the high qualities of Mr. Robert Hammond and his former assistants, Messrs. J. May, G. Spencer Hawes, and Ernest Slater, all of whom were present. He expressed his gratitude to his staff, naming particularly his deputy, Mr. J. R. J. Bowden, "an engineer of conspicuous ability;" Mr. Barham (constructional engineer and his assistant, Mr. Holt, Mr. Dalby (works superintendent), and Mr. Heathman (chief clerk). He had received splendid support also from the electricity committee, and paid a tribute to the work of the contractors and manufacturers. Some 243 cookers had been installed on hire, and many others sold. All that was necessary to develop the service was the proper education of the public. Mr. J. W. Beauchamp had rendered invaluable voluntary service, and coupling his name with the toast, he presented Mr. Beauchamp with a handsome silver salver as a token of appreciation.

Mr. J. W. Beauchamp expressed his thanks, attributing the hearty support that the undertaking received to the personality of Mr. Robinson and the backing he received from the Mayor and Council. He said the manufacturers appreciated a function of this kind as one of the best "business-getters" imaginable.

Lastly, the health of the Chairman was proposed by Councillor C. F. Day; it was drunk with musical honours, and responded to by the Mayor.

A programme of music followed, and the function closed at a late hour.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Strictly Home Office?

With reference to your correspondent's letter in your issue of the 26th inst., under the heading "Strictly Home Office," I find from experience that many of the fuse troubles experienced at the present time are due to the misinterpretation of, or too narrow meaning given to, the Home Office Regulations. The efficiency of fuse units is being sacrificed in the mistaken endeavour to provide a fuse carrier, and base, which will have the end terminal clips covered whether the handle is in position or not. All that is reasonably required by the regulations is to have a fuse carrier with the fuse wire and live contacts covered, in order that the *hand of the operator may not inadvertently touch live metal*, when inserting or withdrawing a fuse carrier from a live circuit, and further to prevent his hand being burnt due to an arc, and the scattering and blowing of metal into his face. When the endeavour is made to have the end terminal contacts totally enclosed whether the handle is in position or not, in the majority of cases it has resulted in a badly ventilated handle, usually with the ends closed, and the fuse wire passing through small holes in the porcelain, against which the arc spits, resulting in the breaking of the handle. Further, it is not generally known that the loss and heat set up by a piece of copper fuse wire arranged to fuse at 100 per cent. overload is considerable. For instance, take the watts lost in two pieces of No. 18 S.W.G. tinned copper fuse wires in parallel, arranged to fuse at 180 amps., and to carry a continuous load of 50 per cent. to 60 per cent. of the fusing current; at 50 per cent. load the watts lost is 45, and at 60 per cent. load the watts lost is 105, this on a length of fuse wire required for a standard handle to B.E.S.A. specification. As this loss is given off in the form of heat the importance of having a properly ventilated handle, with a free current of air circulating if possible from the bottom to the top, will be at once recognised. Not only does the handle become too hot to touch, but as the heat is continuous and cumulative, it is directly conducted through the fuse wire to the end terminal clips, and if these are made of the usual thin sheet brass, copper, or phosphor bronze, they lose their springy nature, and the further trouble of bad contact is set up. This is due to the fact that the pressure between the contacting surfaces is at least of as much importance in securing absence of heating as the provision of adequate contacting area. As designer of this class of material I have eliminated these fundamental defects, first by giving ample ventilation through tubes open at both ends,

to obtain a free circulation of air and blow out the arc; secondly, by providing solid cast end clips of channel formation with ground faces into which the self-aligning fuse clips are wedged under pressure. These clips are free to move in all directions, thus giving perfect surface contact over the whole area of the contacting surface; and thirdly, by providing for a definite known pressure between those surfaces, which cannot be destroyed. To further increase the efficiency of the unit in the larger types of handles from 200 A to 700 A continuous rating, special elements are used, known as "Artic fuse elements," wherein the heat generated and watts lost are less than 25 per cent. of the losses in the usual piece of copper fuse wire previously referred to. In order to overcome the oxidation of surfaces and corrosion referred to in your correspondent's letter, all metal parts are electrolytically tinned. Under test the units to these designs have given remarkable results, and even the porcelain handle type units, which come under the category of "light-duty fuses" to B.E.S.A. specification, have repeatedly cleared a dead short without any damage to the handles, where other types of units subjected to the same tests have been blown to pieces. The calculated dead short current on these tests was 53,000 A, on a 440-V circuit. With the indestructible type handles for larger powers they have repeatedly cleared the circuit on a dead short across a large transformer, the instantaneous load being 5000 kVA.

Technical Adviser and Chief Designer,
The Artic Fuse & Electrical Manufacturing Co.

Birkenhead, *October 29th*, 1923.

With reference to Mr. W. E. Rogers's letter in your issue of October 26th, under the above heading, may we be permitted to point out that we have for some years been manufacturing and supplying standard ironclad switch and fuse gear at a reasonable price which fully meets every objection to which he refers?

Every one of our products is standardised, and can be supplied promptly (generally from stock) at reasonable competitive prices. All the component parts of our apparatus are manufactured by ourselves, are standardised, and replacements can be provided when necessary from stock.

The whole of our ironclad switch gear is designed with a view to assisting the erector, and particular attention is always paid to the space provided for cables; if we were supplying a board to receive 61/.103 v.i.r. cable we should think it absurd if we did not provide for such a cable to run direct to its connection without bending.

Our fuses are all designed so that when the handle is removed every particle of "live" metal is efficiently shielded, and we are able to supply switch and fuse gear covering these details from 15 to 400 A per way.

All our contacts are made of hard rolled copper, brass not being used.

While we fully agree with the general trend of your correspondent's remarks, may we suggest that ironclad switch and fuse gear meeting his requirements cannot be produced at the same price as many of the competitive lines which are sold as "Home Office," but for which the manufacturers will not give the same unqualified guarantee that we are able to give.

Every piece of "Home Office" apparatus which we supply is guaranteed without qualification, to meet the requirements of the Home Office for the use of electricity in non-textile factories and other similar positions.

We shall be pleased to send your correspondent a descriptive catalogue and price list, or to show him a comprehensive range of samples in our showroom.

Donovan & Co.

Birmingham, *October 29th*, 1923.

Mr. W. E. Rogers's letter "Strictly Home Office?" in your current issue will be read, I am sure, with great interest by many manufacturers of ironclad switchgear. They will all agree with him about the vagueness of the Home Office recommendations and requirements in respect of switchgear in general, but that is not their fault. A few other points might go home to some of them. At the same time, I think Mr. Rogers should not make such sweeping assertions with reference to all manufacturers in respect of their designs, prices, deliveries, &c., until he is certain that he has communicated with all of them. Although the firm in which I am interested has supplied switches to Mr. Rogers's instructions, we find no trace of ever having received inquiries from him for ironclad distribution boards with, or without, his fads, and consequently have had no chance of quoting "inflated faddist's prices," nor of "blackmailing" any of his erectors in the way he states. The opportunity of doing so would be very much appreciated.

Arthur W. Cox, A.M.I.E.E.

Luton, *October 29th*, 1923.

Applications for Patents.

It has been suggested to us that the mention of our name at the head of the list of patent applications which has been a feature of the Electrical Review for nearly twenty years misleads your readers into thinking that all the applications in the list were lodged by ourselves, and that we are the only patent agents dealing with electrical inventions.

We do not believe that any such misapprehensions exist; but for the satisfaction of those who fear them, we point out that the lists are compiled from official records, and are intended to include all applications relating to electrical inventions, whether lodged by the inventors personally, or by other patent agents, or by ourselves. Further, we point out to your readers that if they desire the advice or assistance of a patent agent, there are over three hundred to choose from, whose names and addresses may be found in the Register of Patent Agents obtainable for sixpence from Messrs. Eyre & Spottiswoode, of East Harding Street, Fleet Street, E.C.4.

Sefton-Jones, O'dell & Stephens,
A. J. Stephens.

London, *October 25th*, 1923.

Wireless Apparatus.

It has probably been found out by many electrical contractors who have been practically compelled to sell wireless apparatus that the sale of this, owing to the extremely small discount allowed, is not proving itself very remunerative.

The conditions will probably vary in different towns, that is, it might show quite a good financial return in London, Newcastle, Manchester, and other places where a broadcasting station is in operation close by, but when it comes to anyone who is situated at such a distance from the nearest station that a two-valve set is the least that can be used, it will be found that the more numerous customers we get are country ones.

It is not necessary for me to point out to any of your readers who, no doubt, themselves carry on a country as well as town practice, that the cost of country work is very much larger than that of town, so that I, unfortunately, find the whole of the discount allowed in connection with wireless articles goes in courtesy visits, and in actually selling them. To quote two concrete cases, I find that after spending a considerable amount of my own time, and the time of my staff, I actually lose on quite 50 per cent. of the transactions I undertake in this line, to say nothing about the rest just paying their way.

We cannot, of course, get any more than the fixed price for these things, which is quite different to giving an estimate for wiring work in the country, as your profit scale can be adjusted, and it is also very different to supplying the actual articles in the town where your business is.

I have no doubt other electrical contractors, besides myself, have found that so far from these machines selling themselves, they take a considerable amount of work and expensive labour to handle them, and hence the discount off the list should not be less than 33⅓.

I think that at the present time the manufacturers of these articles are certainly making money, but I doubt very much if the retailer is, as in the face of these discounts, which are not sufficient to cover the selling costs, there is the constant reduction of cost with the consequent loss every time on the stock which one holds.

I think it was suggested that this was to be a form of trading which would be satisfactory to the British manufacturer, and I listened to the Postmaster-General stating that anyone making his own set was to use only parts that so far as he knew were manufactured in Great Britain.

I have looked into the windows of several electrical engineers' shops in my own town, and note that some of the apparatus offered in the window is openly marked U.S.A., and others by their prices, and the look of the manufactures, have Germany stamped all over them.

I look in the columns of the electrical Press, and I find French headphones, American valves, German valves, and endless other arrangements of a similar type, so I am rather at a loss to understand what the Postmaster-General means when he makes this order.

I should be very interested if some other electrical contractor would give his views in connection with this, as unless there is going to be some alteration I see no other course than for everyone to make his own sets, as the price at which these are sold in the ordinary way by manufacturers is absurd, if one analyses the cost of the parts.

It is not exactly as if the electrical contractor had any protection in the matter; any motor garage can buy them for the same discount, and some of the motor supply manufacturers offer them in their lists at the same discount as the ordinary contractor has for the resale of them.

I presume that the only way they can do this is to give a definite order for a large number of sets, but I do not think that it is an actual fact that they are doing it.

I shall look forward with interest to any comments from other electrical contractors, but I trust it will be well understood that I am in a town which is nowhere near a broadcasting station, and can therefore only sell comparatively expensive sets.

To show the popularity of wireless in my town, of about 40,000 inhabitants, so far as the town trade is concerned, I am open to make a handsome present to anyone who can count for me more than 12 aerials in the place; all I have to sell has to be sold to people in the country. My shop is in

a prominent street in the town, but I have only sold one set in the town itself, and I have been in the wireless business since its beginning.

Contractor.

October 23rd, 1923.

Small British Motors Wanted.

We are just commencing the manufacture of machinery which has hitherto been made abroad. On each machine is an electric motor, either a.c. or d.c. These motors vary in size from ¼ to 2 h.p., and are required for the different circuits of the British Isles.

Various manufacturers of motors have been approached, but for some reason or other they do not respond to the opportunity. The sales are assured and backed financially to the extent that a first trial order can be placed for 36 motors, and cash paid with order if desired. In spite of this the apathy is astounding.

We write to you thus in the hope that you will be able to help us. We are trying to keep this work in England, but really it is not encouraging.

We enclose particulars of the motors required.

F. Patrick,
Director, F. Patrick, Ltd.

Leeds, *October 29th*, 1923.

The G.P.O. and Electricity Undertakers.

The recent article by Mr. W. H. Stoker, K.C., which called attention to the position taken up by the Postmaster-General in the direction of unnecessary obstruction of the work of electricity supply, may be usefully extended by further examples of the treatment of electricity undertakers by the Post Office. The dissatisfaction with the Post Office amongst those responsible for electricity undertakings is undoubtedly widespread and increasing. It is caused by the conviction that members of the Post Office engineering staff dealing with these matters are not fully conversant with the subject from the power supply point of view, and that the officials quite wrongly imagine that the Post Office, having in the past been the only user of overhead lines—apart from railways—the monopoly given to that department in respect of sending messages extends to something like a right of pre-emption of the earth and air for electrical purposes.

Other users are looked upon as existing on sufferance, and the Post Office lines are assumed to be of first importance to the community, although it is not clear why sending messages should be more important to the community than the transmission of power.

The layouts of important new lines of electricity undertakers are often spoiled to preserve existing unimportant Post Office lines, not merely free from danger, but from any variation from the standard methods employed by that department, drawn up before there were others using "air lines."

The Postmaster-General actually sets up the monstrous claim that he may erect a new line near an existing line of an electricity supply authority, and throw upon the electricity authority all the expense of alterations of the undertaker's lines, or of deviation of the Postmaster-General's new line from his standard practice, to comply with his own ideas of safety. The claim is based on the following:—

(1) The Electricity Commissioners' regulation: "Where an overhead line crosses or is in proximity to any other wire or metal, precautions shall be taken by the undertakers against contact between a conductor which is not connected with earth and any other wire or metal by 'leakage or otherwise.'"

(2) Section 26 of the 1888 Act, which states that: "The undertakers and their agents shall conform with such *reasonable* requirements either general or special as may from time to time be made by the Postmaster-General, for the purpose of preventing any telegraph of the Postmaster-General from being injuriously affected by the said works."

The Post Office claims that the Postmaster-General is advised that provision (1) applies to Post Office telegraph wires whether constructed before or after the power line, and he holds that in strictness the whole cost of the "necessary" protection falls to be borne by the electricity undertakers, but it is his usual practice when "second comer" to bear half the cost of this arrangement.

Surely this "act of grace" is a sign of an uneasy conscience. The Postmaster-General, through his officials, knows he is doing an injustice or he would not feel that any act of grace was called for.

Provision (2) is claimed to enable the Postmaster-General to make rules and enforce them against electricity undertakers. The word "reasonable" is ignored by the Post Office authorities, and the "necessary protection" is claimed to include anything the Postmaster-General may demand.

Another case may be of interest: A line was objected to on the ground that, *being high pressure*, it might cause interference with a Post Office line parallel to it on the opposite side of a wide public road. The officer concerned seems to be unaware that the pressure has no bearing on the subject, except in the opposite sense to that imagined by him, namely, by reducing the current and therefore the induction. Here we have a proof of the lack of accommodation of the Post Office. If this Post Office claim were admitted, the existence of a Post Office line on one side of a road would close the other side to power lines.

It is interesting that the objection has been transmitted through the offices of the Electricity Commissioners without comment, which indicates the policy of that body to be a wise one of strict neutrality.

At present plans and particulars are sent to the Commissioners. The plans are in due course forwarded to the General Post Office, and in *overdue* course a reply is received by the Commissioners, which they transmit after a decent interval to the electricity undertakers. A reply is then sent to the Commissioners and they repeat the passing-on process. A month at least would be saved by dealing directly with the General Post Office in each case where any difficulty arises.

By dealing with the matter through the Commissioners there is no opportunity to meet the General Post Office higher officials, who might be amenable to reason at an interview.

Other examples of unreasonable objections and requirements of the Postmaster-General may be enumerated—for instance, the precautions required at road crossings, which are deemed to be sufficient by the Commissioners for the protection of human life, are not nearly sufficient to protect the Postmaster-General's sacrosanct lines. These require a cradle supported upon independent elaborately-earthed steel structures fixed on each side of the crossing!

Again, the rules as to the minimum distance to be maintained between telephone and tramway overhead lines, which are being pushed to deal with electric power lines, are not above criticism, because the existence of dual suspension, catch bars, &c., is not contemplated, as might be expected, in regulations drawn up for tramways, where such guards cannot be used.

It is now necessary to secure recognition of the fact that electric power lines are at least of equal importance to Post Office message lines. This can best be effected by demanding arbitration, provided for in the 1888 Act, in every case where the Post Office authorities act as if such were not the case, and by impressing this fact upon the arbitrator every time.

If the "Saving Clause" in the Acts and Provisional Orders does give the Postmaster-General injurious preference, an agitation to alter the law would be in the public interest.

Finally, a speeding-up is needed in dealing with overhead lines, both in the offices of the Commissioners and in relation to the General Post Office.

The delays at present suffered in the various offices make it more tedious to erect an overhead line than to lay an underground main, thus losing for us the chief advantage of the former, which is speed.

W. Fennell, M.I.E.E.

Northwich, *October 27th*, 1923.

Improving the Shape of Alternator Waves.

In their recent paper before the British Association, entitled "A Method of Improving the Wave-shape of Alternators," Prof. Marchant and Mr. Turney described an arrangement consisting of a condenser and reactance shunted across the line, the condenser and reactance being related in the well-known manner for producing resonance.

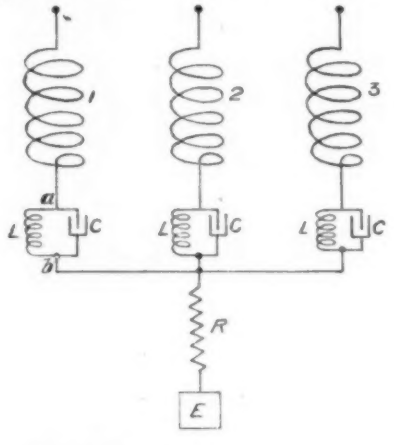
A brief description of an harmonic filter which is being successfully used by the British Thomson-Houston Co., Ltd., for the same purpose may be of interest. This was referred to by Mr. Jack in the discussion on the above paper. He spoke extempore, however, and the localities he mentioned were not actually those where the device had been used.

When the matter was first investigated, the machine concerned was a 550-kVA, 3-phase, 3,300-volt, 50-cycle generator, run with neutral earthed through the usual resistance, and interference with telephones was experienced. This was traced to 35th and 37th harmonics in the voltage wave, resulting from a design feature which has been corrected on later machines. Trials were made with various forms of harmonic filters. One of the circuits tried was that first described by Mr. Albert Campbell and applied by him to the exact measurement of frequency. In this circuit a combination of mutual inductance and capacity was used, their product being adjusted to correspond to the frequency. The trial showed that the adjustment could be made sufficiently delicate to cut out either the 35th or the 37th separately and completely, leaving the other harmonic. The arrangement was not adopted, however, as it involved the use of a condenser suitable for full-phase volts.

The scheme finally used consisted in placing at the neutral point in each phase an air-cored inductance of low value and a condenser connected in parallel, the circuit being tuned to the mean of the two harmonic frequencies. This formed a so-called "rejector" circuit, which allowed the 50-cycle load current to pass freely, but interposed a high impedance in the path of the objectionable harmonics.

In the figure, 1, 2, and 3 are the phase windings of the machine, L and C the inductance coils and condensers forming the filter, and R the usual earthing resistance.

It will be noted in this arrangement that, first, the condensers are not required to withstand the full 50-cycle line voltage, but only the smaller voltage of the harmonic; and secondly, that the whole apparatus is normally at earth potential. The effectiveness of such an arrangement depends, of course, primarily upon the extent to which the effective resistance of the coil and condenser at the harmonic frequency can be reduced. The resistance offered to the harmonic current between the filter terminals *a* and *b* is closely equal to $\frac{R}{(2n)^2}$ ohms, where R is the sum of the resistances of coil and condenser.



The above-described arrangement, which is in successful use, is a "filter" rather than a "resonant shunt" as used by Prof. Marchant.

As already pointed out, the filter appears to have an advantage over the shunt, in that the condenser has not to withstand the full line voltage, so that a condenser breakdown would not introduce risk of damage, nor necessitate shutting down.

In conclusion, I think a word of caution should be given. The device was applied by the British Thomson-Houston Co., Ltd., to meet a complaint regarding telephonic interference, and it afforded a solution because the complaint was in regard to two similar notes and not in regard to a number of notes of widely different frequencies which combine together to make a disturbing noise. A number of other investigations of telephone disturbance shows that often the disturbing current is of so complicated a wave shape that the simple devices here under discussion are not applicable without introducing undesirable complications.

R. C. Clinker.

Rugby, *October 24th*, 1923.

Diesel-Electric Ship Propulsion.

In your issue of October 26th, you have an editorial, dealing with Diesel-electric propulsion. I cannot agree with some of the conclusions reached by the writer, who does not appear to be in touch with modern motor-ship practice. It is stated that with some marine internal-combustion engines, consumption figures as low as 0.3 to 0.4 lb. of oil per i.h.p.-hour are attained. No engine has yet achieved the lower figure mentioned. The average attained at sea is from 0.38 to 0.42 lb. per b.h.p.-hour.

You next remark that the cost of maintenance is very high, and many instances of break-down have to be recorded. From a knowledge of the performance of a large number of motor ships, I can definitely say that the cost of maintenance of a motor ship with well-designed machinery is no more, and is frequently less, than that of a steamer, whilst the reliability is equal to that of a reciprocating steam-engined vessel, and generally superior to a geared turbine ship.

It is next asserted that at speeds of between 70 and 80 r.p.m. the direct-coupled oil engine becomes very heavy. You will note that in the Diesel-electric ship with which you are making comparisons, the propeller speed is 95 r.p.m., and I believe I am correct in stating that there is practically no difference in the machinery weight of this vessel as compared with a direct-driven Diesel ship.

Finally, you remark that the reversing gear of marine Diesel engines is often very complicated, that it is a difficult matter to change the speed of the engine quickly from full ahead to full astern, and that to obtain intermediate speeds, particularly very low speeds, is also very difficult.

The reversing mechanism of a Diesel engine is, on the contrary, very simple, involving, as it does, only two cams on the camshaft for each valve instead of one, and a means of moving the camshaft fore and aft. It is obviously very much less complicated than the Diesel-electric dirve, which needs the use of dynamos, switchgear, cables, and an electric motor. A Diesel engine of the same power as the electric motor in the Diesel-electric ship *La Playa* can reverse from full ahead to full astern in 11 seconds. Moreover, it has a range of speed from 25 r.p.m. up to the maximum, which is usually about 85 r.p.m. There is thus no difficulty, either in reversing or in obtaining low speed of rotation, and all captains of motor ships agree that these vessels manœuvre considerably better than steamers.

These facts should be made clear in order to show that it is not because of any defect of the direct-driven Diesel ship that the electrical system has been employed in the *La Playa*, but because the owners considered that in this particular vessel, the employment of electricity offered certain advantages. For the average cargo or passenger vessel, the Diesel-electric principle with its complications, its presumably high cost, and its 15 per cent. loss of efficiency in electric transmission, is unlikely to make any headway against the direct-driven motor ship, which is now being built in sizes up to 22,000 tons, with individual engines of 6,750 b.h.p.

A. P. Chalkley,
Editor, *The Motor Ship*.

London, *October 29th*, 1923.

[With reference to Mr. Chalkley's remarks regarding fuel consumption, it is to be noted that our figures were based on published trial results. We have before us particulars of the trials of a marine Diesel engine in which the consumption is given as 0.1265 kg. (0.28 lb.) per i.h.p. per hour, and many similar results could be quoted. As regards the question of weight and the complexity of the direct-coupled Diesel engine, we may quote from the paper read by Mr. James Richardson before the British Association last year, in which he says: "The (marine) Diesel engine still remains a massive and somewhat complicated power plant, and no movement towards simplification has yet definitely set in." Whatever opinion Mr. Chalkley may have regarding our knowledge of marine problems, he will at least admit that Mr. Richardson is in touch with modern practice. Finally, on the question of first cost and reliability, many authorities could be quoted in justification of our statement, and we would ask why it is that the majority of shipowners, who as hard-headed business men cannot be accused of bias in favour of any one system of propulsion, have yet to be convinced of the superiority of the direct-driven motor ship.—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

25,442. "Electromechanical starting and stopping device for photographic shutters, &c." C. P. Lingwood, C. G. Lowen, and Pictorial Machinery, Ltd. October 12th.
25,455. "Crystal holders for wireless receiving sets." F. W. Burlton. October 12th.
25,456. "Reception of radio signals." Marconi's Wireless Telegraph Co., Ltd. October 12th. (United States, December 28th, 1922.)
25,457. "Electric control devices." A. H. Curtis, G. Holdway, Igranic Electric Co., Ltd., and A. H. Mackley. October 12th.
25,460. "Mercury arc rectifiers." E. Marschner. October 12th.
25,462. "Electrical cut-outs." J. Vallerius. October 12th.
25,467. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th.
25,476. "Electrolytic rectifiers." M. A. Codd. October 12th.
25,490 "Devices for production and amplification of electrical oscillations for telegraphy, &c." A. R. Angus. October 12th.
25,497. "Electric vacuum tubes." H. Konemann. October 12th.
25,503. "Electric sign." P. Krout. October 12th.
25,505. "Apparatus for converting alternating-current electrical energy to direct-current electrical energy." R. F. Hamilton. October 13th. (United States, September 8th.)
25,508. "Head-lights for motor-cars." W. J. Hedley. October 13th.
25,509. "Headphone attachment for wireless receiving sets." D. Smith and R. H. Smith. October 13th.
25,513. "Terminals for electric cables." W. A. E. Tyers. October 13th.
25,518. "Crystal detectors." E. J. Bastock. October 13th.
25,526. "Electric furnaces, &c." T. Rowlands. October 13th.
25,529. "Wireless receiving sets." J. Smithies. October 13th.
25,543 "Electric signalling apparatus." G. A. Goad and W. Scott. October 13th.
25,550. "Electric trigger release for operating bolts, locks, &c." A. Miller October 13th.
25,551. "Variable electric condensers." M. V. Pirie. October 13th.
25,565. "Induction coils." R. E. Beswick and P. N. Glendining. October 13th.
25,571. "Automatic, &c., telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, W. H. Paulett, and F. Tench. October 13th.
25,574. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 13th. (United States, October 12th, 1921.)
25,584. "Obtaining a deposition of chromium by electrolysis." A. J. Coignard. October 13th.
25,589. "Means for production of high electric potentials." E. Taylor-Jones. October 13th.
25,598. "Rheostats." T. N. Cole, R. P. Richardson, and G. D. Ward. October 13th.
25,599. "Loud-speaking telephones, &c." M. R. Lawrence and Sterling Telephone and Electric Co., Ltd. October 13th.
25,604. "Commutators for electric ignition systems of automobiles, &c." F. W. Baker. October 15th.
25,605. "Electric generators." F. Hoffman, C. A. Miller, and F. J. Miller. October 15th.
25,636. "Diaphragms for phonographs, telephones, &c." F. O. Casson and C. Edwardes. October 15th.
25,644. "Clip to attach electric lamps to cycles." J. B. Hopkinson. October 15th.
25,646. "Engine starters." Eclipse Machine Co. October 15th. (United States, January 4th.)
25,647. "Engine starters." Eclipse Machine Co. October 15th. (United States, February 3rd.)
25,649. "Rheostats and potentiometers." M. M. Houghton. October 15th.

25,730. "Telephony." G. H. Fletcher. October 16th.
25,742. "Sparking plugs." R. Bosch Akt. Ges. October 16th. (Germany, October 10th, 1922.)
25,743. "Devices for automatic connection of electric conductors." A. G. P. M. Poirault de la Porte. October 16th. (France, May 16th.)
25,749. "Power relay apparatus." H. Isherwood. October 16th.
25,763. "Electric motors for hoisting, &c." R. Christie. October 16th.
25,764. "Crystal detectors." S. S. Bird. October 16th.
25,765. "Electric terminal connection." A. Mousley. October 16th.
25,788. "Method of generating electrical energy." M. H. Tate. October 16th.
25,793. "Electric switch for wireless apparatus." W. F. Hurndall. October 16th.
Operating handles for electrical apparatus." F. G. Cooke. October 16th.
Crystal rectifiers." M. M. Melinsky and E. H. Millington. October 16th.
25,804. "Vacuum tube circuits." W. L. McPherson and Western Electric Co., Ltd. October 16th.
25,813. "Telephonic receiving apparatus." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. October 16th.
25,818. "Apparatus for exhausting electric lamp bulbs, &c." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 16th. (Holland, October 27th, 1922.)
25,832. "Apparatus for generating alternating currents." W. Dubilier. October 16th.
25,852. "Telephone receiving apparatus." J. Bethenod. October 16th. (France, October 28th, 1922.)
25,857. "Vacuum, &c., apparatus for electric discharges through gases, &c." H. L. Down. October 16th.
25,858. "Electrical measuring instruments." G. Campos. October 16th.
25,859. "Balanced electric protective arrangements for alternating-current systems, and relays therefor." B. H. Leeson and A. Reyrolle & Co., Ltd. October 16th.
25,865. "Variable condenser." C. Kralt. October 17th.
25,867. "Electric fuses." E. Hope. October 17th.
25,869. "Reflectors for electric, &c., lighting." S. Leech. October 17th.
25,871. "Radiant-heat or electric-light baths." R. Springer. October 17th.
25,874. "Wireless telegraph, &c., circuits." A. Stephens. October 17th.
25,890. "Supplying charging currents for underground cables." A. M. Taylor. October 17th.
25,913. "Detachable accumulator case." A. T. Pooley. October 17th.
25,916. "Supports and connections for electric dry cells, &c." R. E. H. Carpenter. October 17th.
25,917. "Anti-distortion device for radio-telephonic receivers." R. E. H. Carpenter and H. R. Rivers-Moore. October 17th.
25,919. "Electro-magnetic step-by-step mechanism." Coventry Automatic Telephones, Ltd., and A. R. Kahl. October 17th.
25,921. "Balancing signalling conductors with artificial lines." Western Electric Co., Ltd. October 17th. (United States, December 16th, 1922.)
25,931. "Filament resistance, &c., for wireless telegraphy, &c." R. T. Wallace. October 17th.
25,944. "Automatic telephone systems and switching apparatus therefor." H. Baron (F. Aldendorff). October 17th.
25,945. "Automatic telephone systems and switching apparatus therefor." H. Baron (F. Aldendorff). October 17th.
25,946. "Automatic telephone systems and switching apparatus therefor." H. Baron (F. Aldendorff). October 17th.
25,955. "Sound amplifier for wireless telephony, &c." A. C. W. Hanson and C. J. W. Hanson. October 17th.
25,971. "Method of television." R. F. Hamilton. October 18th. (United States, March 14th.)
25,987. "Aerials for wave signalling systems." A. H. Colley. October 18th.
25,999. "Sound amplifiers." E. J. Whitson. October 18th.
26,000. "Electrical transmission gear for rotary electric furnaces, &c." W. E. Millward. October 18th.
26,002. "Mechanical electric sign." P. Krout. October 18th.
26,019. "Electromagnetic switches." Metropolitan-Vickers Electrical Co., Ltd. October 18th. (United States, October 24th, 1922.)
26,030. "Static transformers." S. Calamatianos. October 18th.
26,032. "Duplex radio-telegraphy." Marrec, Ltd., and Y. Marrec. October 18th.
26,033. "Telegraphy." Marrec, Ltd., and Y. Marrec. October 18th.
26,041. "Electric motors." G. Zambra. October 18th. (Belgium, October 18th, 1922.)
26,056. "Crystal cup for wireless receiving sets." R. V. Langbart. October 18th.
26,063. "Automatic telephone systems." W. Aitken. October 19th.
26,070. "Electric fuses." F. A. Ross. October 19th.
26,080. "Wireless receiving device." E. V. Appleton. October 19th.
26,095. "Variable electric condenser." H. B. Andrews. October 19th.
26,115. "Means for disinfecting telephone mouthpieces, &c." L. V. Burgess. October 19th.
26,124. "Automatic head lamps." A. Edwards. October 19th.
26,128. "Motor-car head lights." P. Dunsheath. October 19th.
26,134. "Electric resistances." N. E. North. October 19th.
26,135. "Impulse transmitting mechanism." Western Electric Co., Ltd. (Deakin, Schreiber & Pappi). October 19th.
26,140. "Process for rendering porous electrodes impermeable to liquids." Soc. Anon. Le Carbone. October 19th. (France, February, 21st.)
26,145. "Cable-guiding devices for mobile electric machines." N. R. Forssblad. October 19th. (France, October 20th, 1922.)
26,172. "Electric signal lamp." R. A. Galloway. October 20th.
26,177. "Cabinets for wireless apparatus." C. W. Hayward and A. J. Stevens & Co. (1914), Ltd. October 20th.
26,187. "Head bands for telephone receivers." R. W. Buttemer. October 20th.
26,198. "Storage batteries." R. E. Milnes. October 20th.
26,199. "Wireless receiving apparatus." L. J. Goldhill and L. P. Linden. October 20th.
26,204. "Electric switches." Mather & Platt, Ltd., F. Whipp, and Whipp and Bourne, Ltd. October 20th.
26,208. "Automatic, &c., telephone systems." J. E. Collyer and Coventry Automatic Telephones, Ltd. October 20th.
26,210. "Electric welding." Dunlop Rubber Co., Ltd., and J. T. T. Randles. October 20th.
26,243. "Auxiliary lights for motor vehicles." J. H. Runbaken and W. Torrance. October 20th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
The name of the applicant's patent agent, if any, will be found on the printed specification.

1922.

9,546. "Earth inductor direction-finding devices." Aeronautical Instrument Co. January 11th, 1922. (191,695.)
9,547. "Earth inductor direction-finding devices." Aeronautical Instrument Co. August 13th, 1921. (184,773.)
10,084. "Electrical condensers." Telegraph Condenser Co., Ltd., W. J. Cole, and S. G. Brown. April 8th, 1922. (204,732.)
10,572. "Electrically-operated warning horns of the diaphragm type." T. G. P. Healey. January 15th, 1923. (204,734.)
15,448. "Magneto-electrical systems for igniting and illuminating motor vehicles." Fahrzeugfabrik Eisenach Zweigniederlassung Der Gothaer Waggonfabrik Akt. Ges. Gotha. March 31st, 1922. (195,579.)
16,088. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 22nd, 1921. (Addition to 15,460/21.) (183,431.)
18,197. "Oil-immersed electric switch fuses." J. Mirrey and H. W. Clothier. July 3rd, 1922. (204,764.)
18,283. "Electric lamp holders." G. O. Donovan and W. Donovan. July 4th, 1922. (204,769.)
18,433. "Printing telegraph system and apparatus with multiple transmission." Siemens Bros. & Co., Ltd., and A. Gordon. July 5th, 1922. (204,773.)
18,461. "Electric incandescent lamps, and lamp holders therefor." H. Workman. July 5th, 1922. (204,774.)
18,562. "Bayonet holders for electric incandescent lamps." C. F. Rainsford. July 6th, 1922. (204,778.)
18,615. "Electrolytic means for preventing corrosion in boilers, condensers, supply tanks, and the like." A. S. Gush. July 6th, 1922. (Cognate application 24,908/22.) (204,781.)
18,623. "Device or apparatus for use when setting or examining the contact points of magnetos and like machines." C. D. G. Franklin. July 7th, 1922. (204,782.)
18,916. "Apparatus for the inspection and control of the sparking plugs of explosion engines." Soc. Anon. des Aeroplanes G. Voisin. July 11th, 1922. (182,816.)
19,043. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). July 11th, 1922. (204,792.)
19,379. "Electrical measuring instruments." K. Edgcumbe and E. L. Everett. July 14th, 1922. (204,798.)
19,834. "Electrically-operated mining plant." W. A. Scott. July 19th, 1922. (204,805.)
19,984. "Electric immersion elements for kettles and other utensils." Electric Heating and Hardware, Ltd., and F. J. Wineberg. July 21st, 1922. (204,809.)
20,036. "Ventilating systems for dynamo-electric machinery." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. July 21st, 1922. (204,810.)
20,479. "Ringing-control arrangements for telephone exchange systems." A. W. Clement. August 10th, 1921. (184,459.)
20,576. "Radio-receiving devices." Capitol Phonolier Corporation. June 2nd, 1922. (198,636.)
20,974. "Devices for securing external sparking plugs for electrical ignition systems." W. H. Duffett. August 1st, 1922. (204,819.)
21,929. "Electrical couplings." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. August 11th, 1922. (204,827.)
22,176. "Tone-clarifying and interference-eliminating means." W. J. Scott. August 15th, 1922. (204,831.)
22,837. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. Hunt and Sandycroft, Ltd. August 22nd, 1922. (Cognate application 4,792/23.) (204,843.)
23,316. "Junction boxes for electric cables." G. H. Scholes. August 26th, 1922. (204,848.)
23,401. "Discharge tubes with enclosed arc-discharge for alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabriken. August 30th, 1921. (185,415.)
23,931. "Recuperable electric cell." C. F. Buffard. September 15th, 1921. (186,052.)
23,945. "Sound vibration responsive apparatus." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 4th, 1922. (204,859.)
24,477. "Manufacture of electric incandescent lamps." Handelsvennootschap Onder de Firma Vogels & Co. (in liquidation). June 26th, 1922. (199,601.)
24,619. "Electrically-driven periodically moving mechanisms." C. D. J. Jamin, jun. October 4th, 1921. (186,902.)
24,952. "Electrodes for electric arc welding." G. Motte. September 16th, 1922. (204,871.)
25,029. "Electric water heater." H. M. M. Colebrook and L. A. Neale (executrices of W. Colebrook, deceased). September 15th, 1922. (Patent of addition not granted.) (204,873.)
25,240. "Electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). September 18th, 1922. (204,875.)
26,005. "High-frequency telephony." Ges. für Drahtlose Telegraphie. September 20th, 1921. (190,699.)
27,567. "Electric discharge tubes and the like." General Electric Co., Ltd., and C. G. Eden. October 11th, 1922. (204,910.)
28,497. "Electric switches." Akt. Ges. Brown, Boveri et Cie. December 14th, 1921. (190,452.)
29,498. "Moulds for the manufacture of glass caps for electric incandescent lamps and similar apparatus." L. S. Vello. October 23th, 1922. (187,989.)
29,500. "Incandescent electric lamps and other similar apparatus." L. S. Vello. October 29th, 1921. (187,991.)
29,770. "Electric luminous discharge tubes." General Electric Co., Ltd., and J. W. Ryde. October 31st, 1922. (204,933.)
31,168. "Galvanic baths." F. Kirschner and J. Hess. November 16th, 1922. (204,954.)
33,921. "Electrical resistance heating apparatus," Dr. N. Zonder. December 12th, 1921. (190,178.)
35,008. "Time switch for electric circuits." A. B. Ballance and W. T. Anderson. December 22nd, 1922. (204,978.)

1923.

424. "Telephone systems." Western Electric Co., Ltd. January 5th, 1922. (191,391.)
2,246. "Electrically-driven pump and blower sets," B. W. Hurd. January 25th, 1923. (205,000.)
2,420. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). January 26th, 1923. (205,002.)
3,807. "Pins for electrical plug connectors." C. L. Arnold and C. R. Belling. February 8th, 1923. (205,010.)
5,586. "Electric thermostatic time switches." Aktiebolaget Birke Regulator. April 10th, 1922. (195,942.)
5,741. "Electrical transformers." Igranic Electric Co., Ltd., A. H. Cardew, S. R. Wright, and E. J. Brunning. February 27th, 1923. (205,013.)
6,344. "Means for driving dynamo armatures." J. F. Cullin. March 5th, 1923. (205,015.)
6,618. "Multi-core cables for long-distance telephony." B. E. D. Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). March 7th, 1923. (205,018.)
7,103. "Interruption of electric circuits." C. Chilowsky. March 20th, 1922. (195,066.)
11,439. "High-voltage connection device, more particularly for the spacing plug cables of internal-combustion engines." Scintilla. June 16th, 1922. (199,361.)
15,873. "Oil-immersed electric switch fuses." H. W. Clothier and J. Mirrey. July 3rd, 1922. (Divided application on 204,764.) (205,034.)
18,708. "Radio-broadcasting systems." Western Electric Co., Ltd. August 14th, 1922. (202,294.)
20,222. "Circuit arrangements for automatic switches of the type used in telephone systems." Automatic Telephone Co., Ltd. July 22nd, 1922. (Divided application on 183,431.) (202,308.)